

**INSTALLATION RESTORATION
PROGRAM (IRP)
SITE INVESTIGATION REPORT FOR
IRP SITES NO.1 and NO.2**

VOLUME I

**162nd COMBAT COMMUNICATIONS GROUP
and 149th COMBAT COMMUNICATIONS SQUADRON
CALIFORNIA AIR NATIONAL GUARD
NORTH HIGHLANDS AIR NATIONAL GUARD STATION
SACRAMENTO, CALIFORNIA**

SEPTEMBER 1995

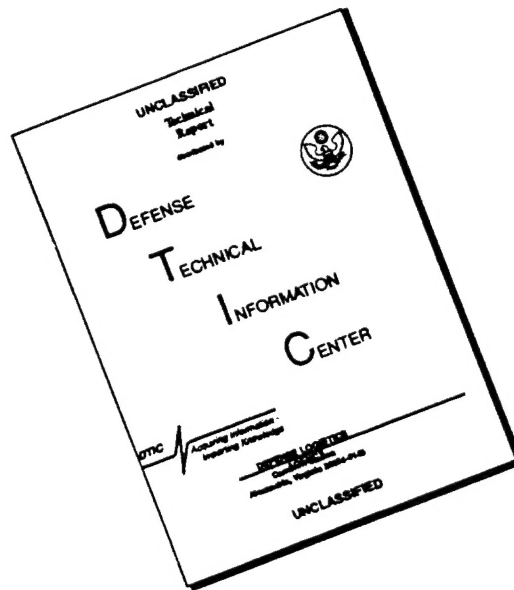


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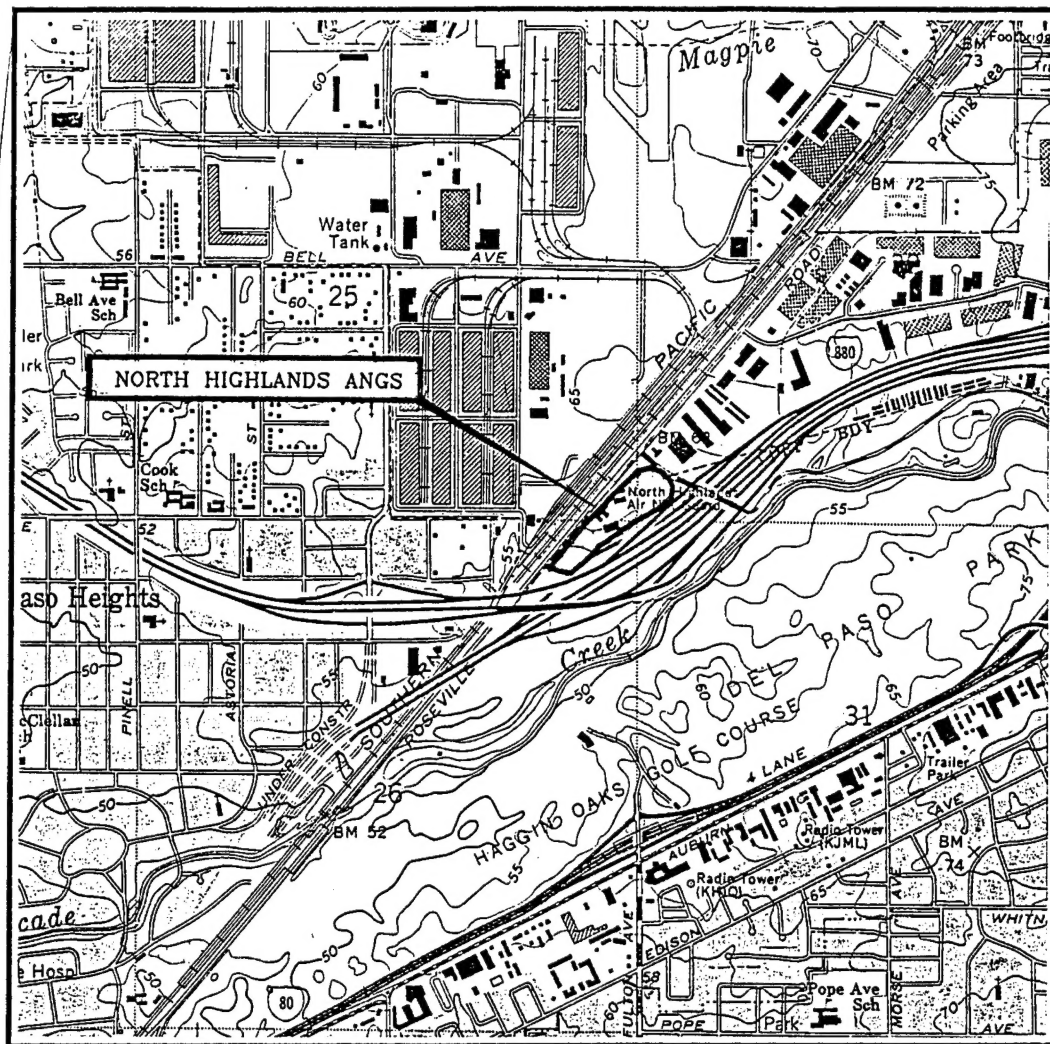
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STATE LOCATION MAP

162nd CCGP & 149th CCSQ
North Highlands ANGS
Sacramento, California

OPTECH
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CORPORATION

SEPTEMBER 1995

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SEPTEMBER 1995

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North Highlands ANG, Sacramento, CA

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LIST OF ACRONYMS

AFB	Air Force Base
AGE	Aerospace Ground Equipment
ANG	Air National Guard
ANGS	Air National Guard Station
ARARs	Applicable or Relevant and Appropriate Requirements
ATHA	Ambient Temperature Headspace Analysis
BGBH	Background Borehole
BH	Borehole
BLS	Below land surface
BTEX	Benzene, toluene, ethylbenzene, xylenes
C	Centigrade
CCGP	Combat Communications Group
CCSQ	Combat Communications Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-Custody
cm/sec	Centimeters per second
DD	Decision document
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DHS	Department of Health Services
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
EO	Executive Order
F	Fahrenheit
FID	Flame ionization detector
FS	Feasibility Study
Ft	Feet
GC	Gas chromatograph
HSA	Hollow stem auger
HQ ANG/CEVR	Headquarters Air National Guard/Installation Restoration Program Branch
IRP	Installation Restoration Program
LTM	Long-term monitoring
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MSL	Mean sea level
MS/MSD	Matrix spike/matrix spike duplicate
ND	Not Detected
NFA	No further action
O&G	Oil and grease
OpTech	Operational Technologies Corporation
OWS	Oil/water separator
PA	Preliminary Assessment

LIST OF ACRONYMS (CONCLUDED)

PID	Photoionization detector
ppb	Parts per billion
PPE	Personal protection equipment
ppm	Parts per million
ppmv	Parts per million by volume
QA/QC	quality assurance/quality control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SM	Standard Method
SVOCs	Semivolatile organic compounds
TDL	Total Designated Level
TEG	Transglobal Environmental Geochemistry
TPH	Total petroleum hydrocarbons
$\mu\text{g/kg}$	Micrograms per kilogram
USEPA	United States Environmental Protection Agency
UTA	Unit Training Assembly
VOCs	Volatile organic compounds

EXECUTIVE SUMMARY

ES 1.0 INTRODUCTION

This Report presents the results of the Site Investigation (SI) conducted at Installation Restoration Program (IRP) Site No. 1 (Old Aerospace Ground Equipment (AGE) Area) and IRP Site No. 2 (Area Behind Vehicle Maintenance), located at the 162nd Combat Communications Group (CCGP) and the 149th Combat Communications Squadron (CCSQ), North Highlands Air National Guard Station (ANGS), Sacramento, California. IRP Sites No. 1 and No. 2 were identified during the Preliminary Assessment (PA) conducted by Science and Technology, Inc. in 1990, and recommended for further investigation under the IRP.

The Headquarters Air National Guard/Installation Restoration Program Branch (HQ ANG/CEVR) authorized Operational Technologies Corporation (OpTech) to prepare an SI Work Plan and conduct the SI at IRP Sites No. 1 and No. 2. This investigation was conducted as outlined in the SI Work Plan submitted to and approved by HQ ANG/CEVR in March 1994. The field investigation at North Highlands ANGS commenced on 20 June 1994 and was completed on 29 June 1994.

The field investigation at North Highlands ANGS included the drilling of 10 soil borings, the collection of 62 soil vapor samples and 24 soil samples, and the surveying of all boring locations.

ES 2.0 IRP SITE NO. 1 (OLD AGE AREA)

IRP Site No. 1 is located on the southwest side of North Highlands ANGS. This area was used for the maintenance of grounds equipment from the early 1960s until 1980. Those maintenance operations resulted in frequent releases of small amounts of waste oils, solvents, fuels, paint, and thinners.

Thallium was the only analyte detected in soil samples collected during the SI at concentrations exceeding Total Designated Levels (TDLs), derived for use as cleanup levels, in accordance with guidance published by the California Regional Water Quality Control Board, Central Valley Region. Three of the 12 samples (including the duplicate sample) exceeded the standard of 10.0 milligrams per kilogram (mg/kg). Thallium was detected at a concentration of 34.0 mg/kg in the soil sample collected from boring BH01-03 from a depth of 58.0 feet below land surface

(BLS) and a concentration of 36.0 mg/kg in samples collected from borings BH01-02 and BH01-05 from a depth of 59.0 feet BLS.

ES 3.0 IRP SITE NO. 2 (AREA BEHIND VEHICLE MAINTENANCE)

IRP Site No. 2 is located on the east side of North Highlands ANG. Small amounts of waste solvents, paints, and thinners were periodically poured along the boundary fence from the late 1950s through the mid-1960s.

Chromium and nickel were the only analytes detected in soil samples collected during the SI at concentrations exceeding TDLs, derived for use as cleanup levels. The California Regional Quality Control Board TDL chromium for this site was 500.0 mg/kg (1,000.0 mg/kg for nickel) above 62.0 feet BLS and 5.0 mg/kg (10.0 mg/kg for nickel) below 62.0 feet BLS. Four chromium samples and four nickel samples out of a total of 13 samples (including two duplicates) exceeded the lower standards. Chromium and nickel were detected at concentrations exceeding TDLs in soil samples collected from boring BH02-04 from depths of 92.0 feet BLS, 105.0 feet BLS, and 110.0 feet BLS. Chromium was detected at concentrations of 10.0 mg/kg, 23.0 mg/kg, 26.0 mg/kg, and 28.0 mg/kg in samples collected from depths of 92.0 feet BLS, 105.0 feet BLS, 105.0 feet BLS (duplicate), and 110.0 feet BLS, respectively. Nickel was detected at concentrations of 12.0 mg/kg, 41.0 mg/kg, 42.0 mg/kg, and 56.0 mg/kg in samples collected from depths of 92.0 feet BLS, 105.0 BLS, 105.0 BLS (duplicate) and 110.0 ft BLS, respectively. These concentrations of chromium and nickel do not exceed the respective ranges of naturally-occurring concentrations of each of these metals in the Sacramento area.

ES 4.0 RECOMMENDATIONS

Based on the results of the SI conducted, the following recommendations are presented:

- The results of the SI indicate no further IRP work is required at IRP Site No. 1. A Decision Document recommending No Further Action should be prepared.
- The results of the SI indicate no further IRP work is required at IRP Site No. 2. A Decision Document recommending No Further Action should be prepared.

SECTION 1.0 INTRODUCTION

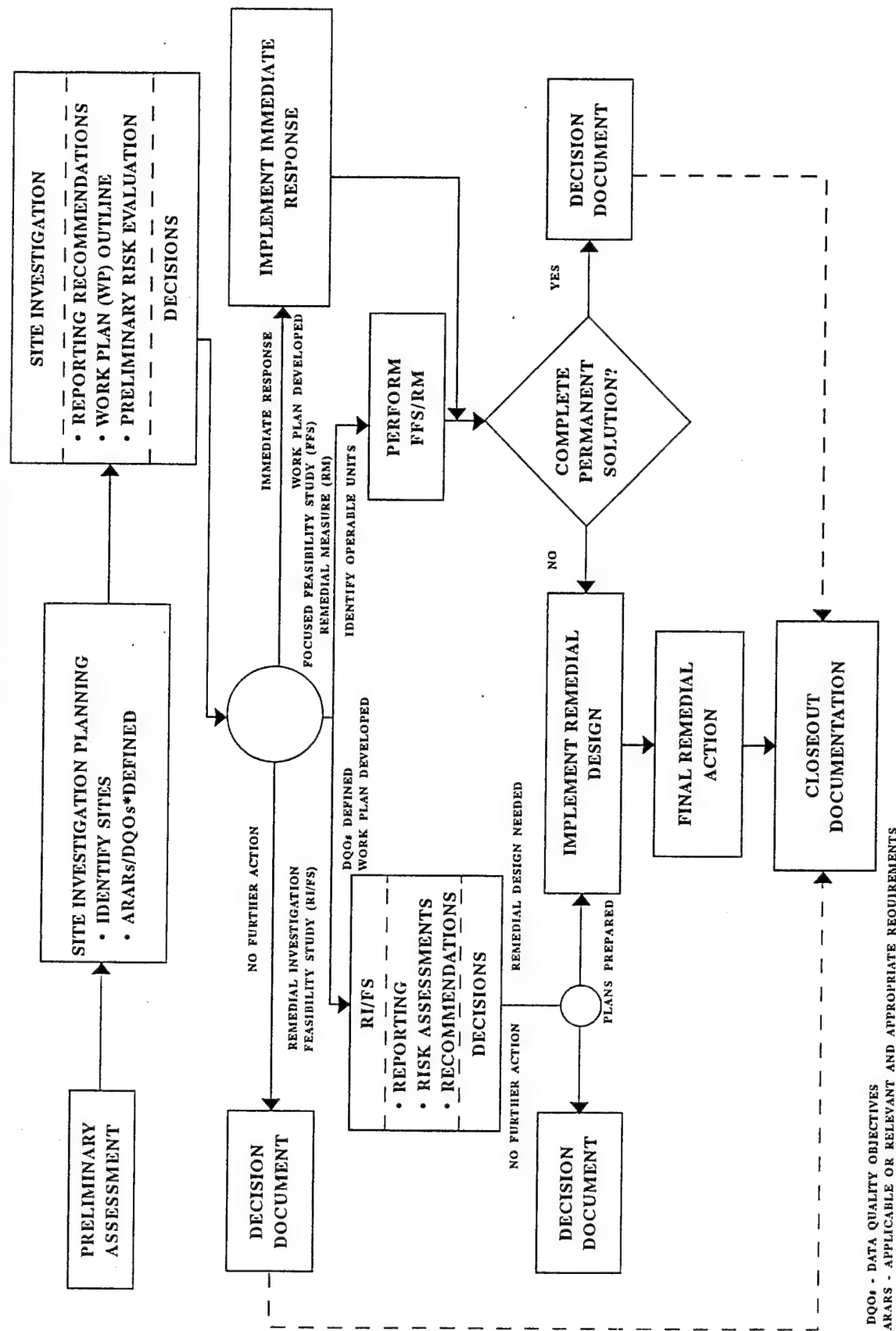
This Site Investigation (SI) Report presents the results of the investigation activities conducted at Installation Restoration Program (IRP) Site No. 1 (Old Aerospace Ground Equipment (AGE) Area) and IRP Site No. 2 (Area Behind Vehicle Maintenance), located at the 162nd Combat Communications Group (CCGP) and the 149th Combat Communications Squadron (CCSQ), North Highlands Air National Guard Station (ANGS) (also referred to as the Station), Sacramento, California (Inside Front Cover Figure). A Preliminary Assessment (PA) of the 162nd CCGP and the 149th CCSQ, North Highlands ANGS was conducted by Science and Technology, Inc., in April 1990. Information obtained through interviews, review of Station records, and field observations resulted in the identification of two potentially contaminated disposal and/or spill sites. These sites were identified as IRP Site No. 1 (Old AGE Area) and IRP Site No. 2 (Area Behind Vehicle Maintenance) and were recommended for further investigation under the IRP.

The Headquarters Air National Guard/Installation Restoration Program Branch (HQ ANG/CEVR) authorized Operational Technologies Corporation (OpTech) to prepare an SI Work Plan and conduct the SI at IRP Sites No. 1 and No. 2. This investigation was conducted as outlined in the SI Work Plan submitted to and approved by HQ ANG/CEVR in March 1994.

1.1 INSTALLATION RESTORATION PROGRAM

The Defense Environmental Restoration Program (DERP) was established in 1984 to promote and coordinate efforts for the evaluation and cleanup of contamination at Department of Defense (DoD) installations. On 23 January 1987, Presidential Executive Order (EO) 12580 assigned specific responsibility to the Secretary of Defense for carrying out DERP within the overall framework of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The IRP was established under DERP to identify, investigate, and clean up contamination at DoD installations. The IRP focused on cleanup of contamination associated with past DoD activities to ensure that threats to public health were eliminated and natural resources were restored for future use. Within the Air National Guard (ANG), HQ ANG/CEVR manages the IRP and related activities.

The IRP is divided into six phases as illustrated in Figure 1.1, and defined and described in the following subsections.



FLOW OF INSTALLATION RESTORATION PROGRAM TASKS

162nd CCGP & 149th CCSq
North Highlands ANG
Sacramento, California

FIGURE 1.1

NORTH\HIGHFLOW

1.1.1 Preliminary Assessment

The PA process consists of personnel interviews, a records search, and Site Inspections designed to identify and evaluate past disposal and/or spill sites that might pose a potential and/or actual hazard to public health, public welfare, or the environment. Previously undocumented information is obtained through the interview process. The records search focuses on obtaining useful information from aerial photographs; installation plans; facility inventory documents; lists of hazardous materials used; subcontractor reports; correspondence; Material Safety Data Sheets; Federal/State agency scientific reports and statistics; Federal administrative documents; Federal/State records on endangered species, threatened species, and critical habitats; documents from local government offices; and numerous standard reference sources.

1.1.2 Site Investigation

The SI phase consists of field activities designed to confirm the presence or absence of contamination at potential sites identified in the PA or during non-related IRP investigations, and to provide data needed to reach a decision point for each site. The activities undertaken during the SI generally fall into three distinct categories: Screening, confirmation, and optional activities.

Screening Activities

Screening activities are conducted prior to drilling activities to gather preliminary data on each site. Screening activities may include the use of such tools as a magnetometer survey to locate underground lines, tanks, and utilities; soil vapor surveys for developing the optimum number and location of soil borings needed to delineate soil contamination, and to be used as a guide in the selection of monitoring well locations; or the installation of a piezometer network in order to determine groundwater flow direction prior to installation of any groundwater monitoring wells.

Confirmation Activities

Confirmation activities include the installation of soil borings and/or monitoring wells; specific media sampling; and laboratory analysis to confirm either the presence or the absence of contamination, levels of contamination, and the potential for contaminant migration. Information obtained during the subsurface investigation is also utilized to define the installation and site hydrology, geology, and soil characteristics.

Optional Activities

Optional activities are used if additional data are needed to reach a decision point for a site, such as no further IRP action is warranted, prompt removal of contaminants is necessitated, or further IRP work is required. Optional activities may include increasing the number of soil vapor sampling points or the number of soil borings and/or monitoring wells to be drilled.

The general approach for the design of SI activities is to sequence the field activities so that data are acquired and used as the field investigation progresses. This is done in order to determine the absence or presence of contamination in a relatively short period of time, optimize data collection and data quality, and to keep costs to a minimum. Information, data, and analytical results obtained from the SI field investigation will support the selection of one of the following decisions:

- **No Further Action (NFA)** – Investigation did not indicate harmful levels of contamination that pose a significant threat to human health or the environment. Therefore, no further IRP action is warranted and a Decision Document (DD) will be prepared to close out the site.
- **Immediate cleanup/remedial activities** – Investigation indicates that the site poses an immediate threat to public health or the environment. Therefore, prompt removal of contaminants or measures to reduce contaminant levels to an acceptable limit is warranted.
- **Remedial Investigation/Feasibility Study (RI/FS)** – Investigation indicates further IRP work is required and the next phase of the IRP needs to be implemented. The RI is described more fully in the following subsection.

1.1.3 Remedial Investigation

The objectives of the RI are to determine the nature and extent of contamination at a site, determine the nature and extent of the threat to human health and the environment, and to provide a basis for determining the types of response actions to be considered (Decision Document, Feasibility Study, Remedial Design, Remedial Action).

The RI consists of field activities designed to identify and quantify the potential contaminant, the extent of the contaminant plume, and the pathways of contaminant migration. Field activities may include the installation of soil borings and/or monitoring wells, and the collection and analysis of water, soil, and/or sediment samples. Careful documentation and quality control

procedures in accordance with CERCLA/SARA guidelines ensure the validity of data. Hydrogeologic studies are conducted to determine the underlying strata, groundwater flow rates, and direction of contaminant migration.

A baseline risk assessment may be conducted which provides an evaluation of the potential threat to human health in the absence of Remedial Action. The assessment provides the basis for determining whether Remedial Action is necessary, justification for performing Remedial Actions, and what imminent and substantial endangerment to public health or the environment exists.

The findings from these studies result in the selection of one or more of the following options:

- **NFA** — Investigations do not indicate harmful levels of contamination that pose a significant threat to human health or the environment. Therefore, no further IRP action is warranted and a DD will be prepared to close out the site.
- **Long-Term Monitoring (LTM)** — Evaluations do not detect sufficient contamination to justify costly Remedial Actions. LTM may be recommended to detect the possibility of future problems.
- **Feasibility Study (FS)** — Investigation confirms the presence of contamination that may pose a threat to human health and/or the environment, and some sort of Remedial Action is indicated. The FS is described more fully in the following subsection.

1.1.4 Feasibility Study

Based on results of the RI, the baseline risk assessment, and a review of State and Federal regulatory requirements, an FS will be prepared to develop, screen, and evaluate alternatives for remediation of groundwater and/or soil contamination at the subject sites. The overall objective of the FS is to provide information necessary for remedial alternatives development. The FS is conducted to support selection of a remedy that is: Protective of human health and the environment; attains applicable or relevant and appropriate requirements (ARARs); satisfies the preference for treatment that significantly and permanently reduces toxicity, mobility, or volume of hazardous constituents as a principal element; and is cost-effective.

Activities associated with the FS include the following:

- Development of alternatives;

- Preliminary screening of remedial alternatives;
- Detailed analysis of alternatives;
- Comparative analysis of alternatives; and
- The creation of an FS Report.

The end result of the FS is the selection of the most appropriate Remedial Action with concurrence by State and/or Federal regulatory agencies.

1.1.5 Remedial Design

The Remedial Design (RD) involves formulation and approval of the engineering designs required to implement the selected Remedial Action identified in the FS.

1.1.6 Remedial Action

The Remedial Action (RA) is the actual implementation of the remedial alternative. It refers to the accomplishment of measures to eliminate the hazard or, at a minimum, reduce it to an acceptable limit. Covering a landfill with an impermeable cap, pumping and treating contaminated groundwater, installing a new water distribution system, and *insitu* biodegradation of contaminated soils are examples of remedial measures that might be selected. In some cases, after the RAs have been completed, an LTM system may be installed as a precautionary measure to detect contaminant migration or to document the efficiency of remediation.

1.1.7 Immediate Action Alternatives

At any point, environmental managers may determine that a former waste disposal site poses an immediate threat to public health or the environment, thus necessitating prompt removal of the contaminants. Immediate action, such as limiting access to the site, capping or removing contaminated soils, and/or providing an alternate water supply may suffice as effective control measures. Sites requiring immediate removal action maintain IRP status in order to determine the need for additional remedial planning or LTM. Removal measures or other appropriate Remedial Actions may be implemented during any phase of an IRP project.

SECTION 2.0 FACILITY BACKGROUND

North Highlands ANGS is located in Sacramento County, approximately six miles northeast of downtown Sacramento and adjacent to McClellan Air Force Base (AFB), as shown in Figure 2.1. The Station occupies approximately 8 acres of relatively flat terrain just to the south of McClellan AFB. Roseville Road and the Southern Pacific railroad tracks are located approximately 100 feet to the north and west of the Station, and Interstate 80 borders the Station on the south and east.

North Highlands ANGS is used as a mobile communication facility with a normal working population of approximately 28 people. The Station serves as a site for Unit Training Assembly (UTA) which meets one weekend per month. During this weekend, the Station population reaches approximately 240 personnel.

2.1 FACILITY HISTORY

North Highlands ANGS was originally constructed in 1950 on land previously used for agriculture. The principal buildings constructed at that time included the Headquarters (Building 1) and the Vehicle Maintenance Shop (Building 4). Since 1950, the land has been occupied by the North Highlands ANGS, specifically the 162nd CCGP and the 149th CCSQ. Their mission is to install, operate, and maintain mobile communication facilities providing interbase and intrabase communications in support of tactical air forces and state emergencies.

In 1968, construction of Interstate 80 changed the boundaries of the Station. Although the size of the Station remained the same, the layout of the Station changed. This construction specifically changed the area behind the Vehicle Maintenance Shop. Before the interstate was built, there was a drainage area located behind the Vehicle Maintenance Shop, but south of the Station's property. Nearly all of the surface drainage from the Station emptied into this area. However, when the fence line was moved to reflect the changed property line, this area was included within the revised Station boundaries. Subsequently, this area was covered with asphalt when the parking area for the Vehicle Maintenance Shop was extended to the new fence line. At this time, a concrete drainage ditch was installed which carries the surface water around the Station's perimeter and empties into the city sewer, located on the north side of the Station. In 1982, the AGE Shop (Building 9) was constructed.

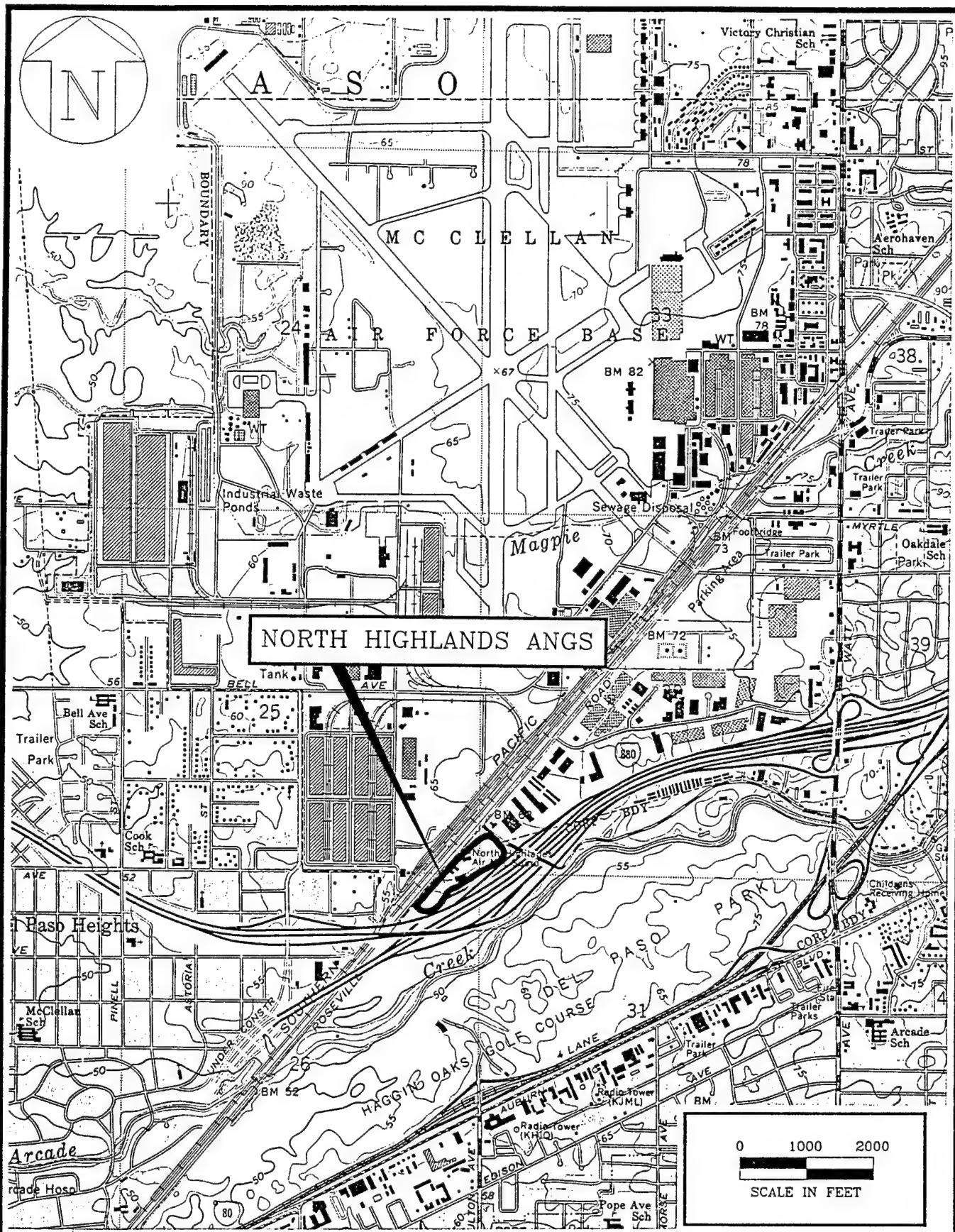


FIGURE 2.1

NORTH\NHGH4-1L

STATION LOCATION MAP

162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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2.1.1 Waste Disposal Practices

Present and past ANG activities at North Highlands in providing communications support have involved the use of potentially hazardous materials and the disposal of potentially hazardous wastes. These activities are associated with vehicle maintenance, generator maintenance, and wash shops. Prior to 1980, the area next to Building 4 was used for wash operations. However, since 1982, the washing operations at the Station have taken place east of Building 9 and south of Building 4. Drainage from the washrack is drawn into an oil/water separator which is connected to the sanitary sewer.

The gravel area on the west side of the Station was used as an AGE maintenance area until the AGE Shop (Building 9) was constructed in 1982. Once this building was finished, all operations concerning AGE maintenance were moved from the gravel area into the new building.

Maintenance operations require the use and disposal of hazardous materials such as lubricants, fuels, solvents, thinners, and paints. Through the years such waste materials have usually been disposed by a contractor or the Defense Reutilization and Marketing Office (DRMO) at McClellan AFB. However, small spills and other releases of these wastes occurred periodically at the Station.

2.1.2 Previous Investigations

A PA of the 162nd CCGP and the 149th CCSQ, North Highlands ANGS was conducted by Science and Technology, Inc., in April 1990. Information obtained through interviews, review of Station records, and field observations resulted in the identification of two potentially contaminated disposal and/or spill sites. These sites were identified as IRP Site No. 1 (Old AGE Area) and IRP Site No. 2 (Area Behind Vehicle Maintenance). These sites are indicated on Figure 2.2. Maintenance operations at IRP Site No. 1 resulted in frequent releases of small amounts of waste oils, solvents, fuels, paints, and thinners. IRP Site No. 2 was used for disposal of small amounts of waste solvents, paints, and thinners. Because the potential for contaminant migration exists at the two sites identified at North Highlands ANGS, each was recommended for further investigation under the IRP.

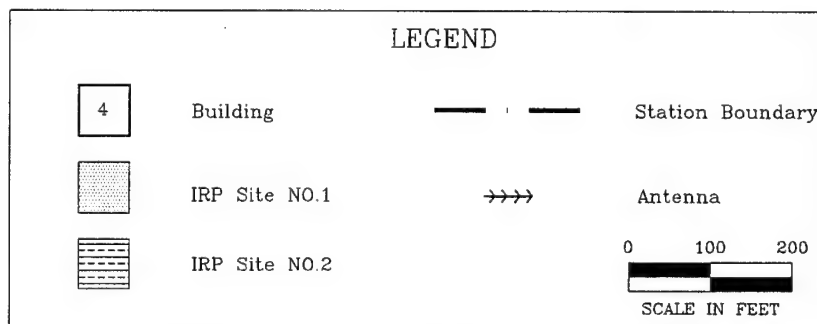
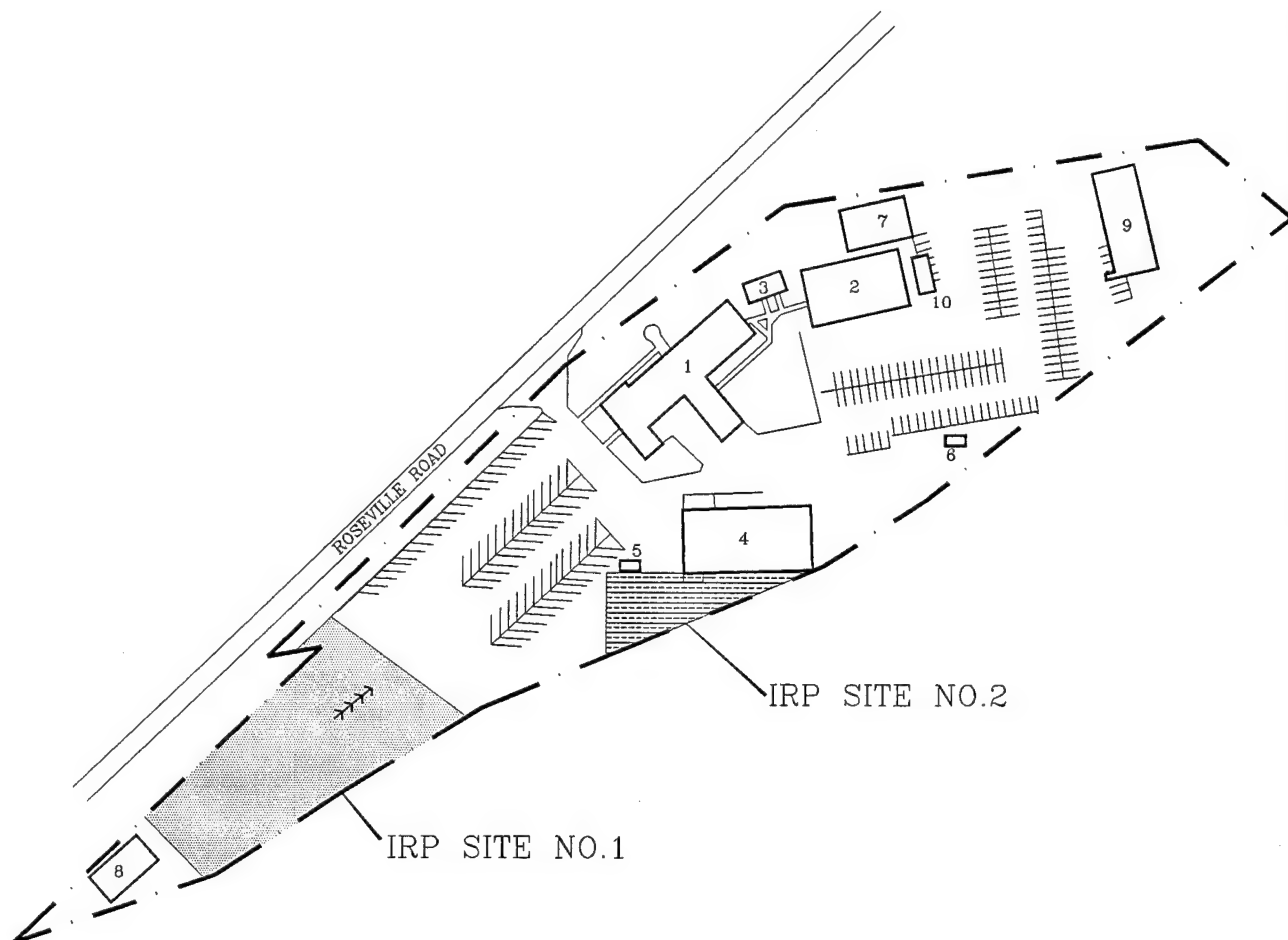
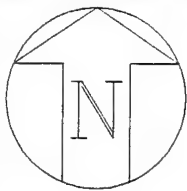


FIGURE 2.2

LOCATION OF IRP SITES
NO.1 AND NO.2
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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CORPORATION

2.2 IRP SITE DESCRIPTIONS

2.2.1 IRP Site No. 1 (Old AGE Area)

IRP Site No. 1 is located on the southwest side of North Highlands ANGTS (see Figure 2.2). The site is approximately 120 feet wide and approximately 320 feet long (see Figure 2.3). The site is covered with compacted, rocky soil having a sparse, vegetative cover. An antenna is located in the north central portion of the site. Asphalt borders the site to the northeast and a 6-foot high security fence bounds the site to the southeast, southwest, and northwest. Located outside the Station boundaries, an open storm drain parallels the fence line southeast of the site, and drainage ditches parallel the fence lines located to the southwest and northwest.

2.2.1.1 History of Activities

This area was used predominantly for the maintenance of ground equipment, including vehicles and generators, from the early 1960s until 1982 when the new AGE Shop was constructed. Those maintenance operations resulted in frequent releases of small amounts of waste oils, solvents, fuels, paint, and thinners. The actual quantities of the releases are unknown. During the installation visit conducted for the PA in April 1990, no noticeable soil staining or other visible signs of release were observed.

2.2.2 IRP Site No. 2 (Area Behind Vehicle Maintenance)

IRP Site No. 2 is located on the east side of North Highlands ANGTS (see Figure 2.2). The site is located immediately behind Building 4, the Vehicle Maintenance Shop, and extends to the west approximately 85 feet, and then extends south to the boundary fence line (see Figure 2.4). The site is covered with asphalt and is used for storage of vehicles and grounds/vehicle maintenance equipment. Waste oil, antifreeze, and fuel/transmission filters are also stored at the site in 55-gallon drums. A washrack and oil/water separator, which was installed in 1973, are located behind the southwest corner of Building 4. Drainage from the washrack flows into the oil/water separator which is connected to the sanitary sewer. Located outside the Station boundaries, an open storm drain parallels the fence line south of the site.

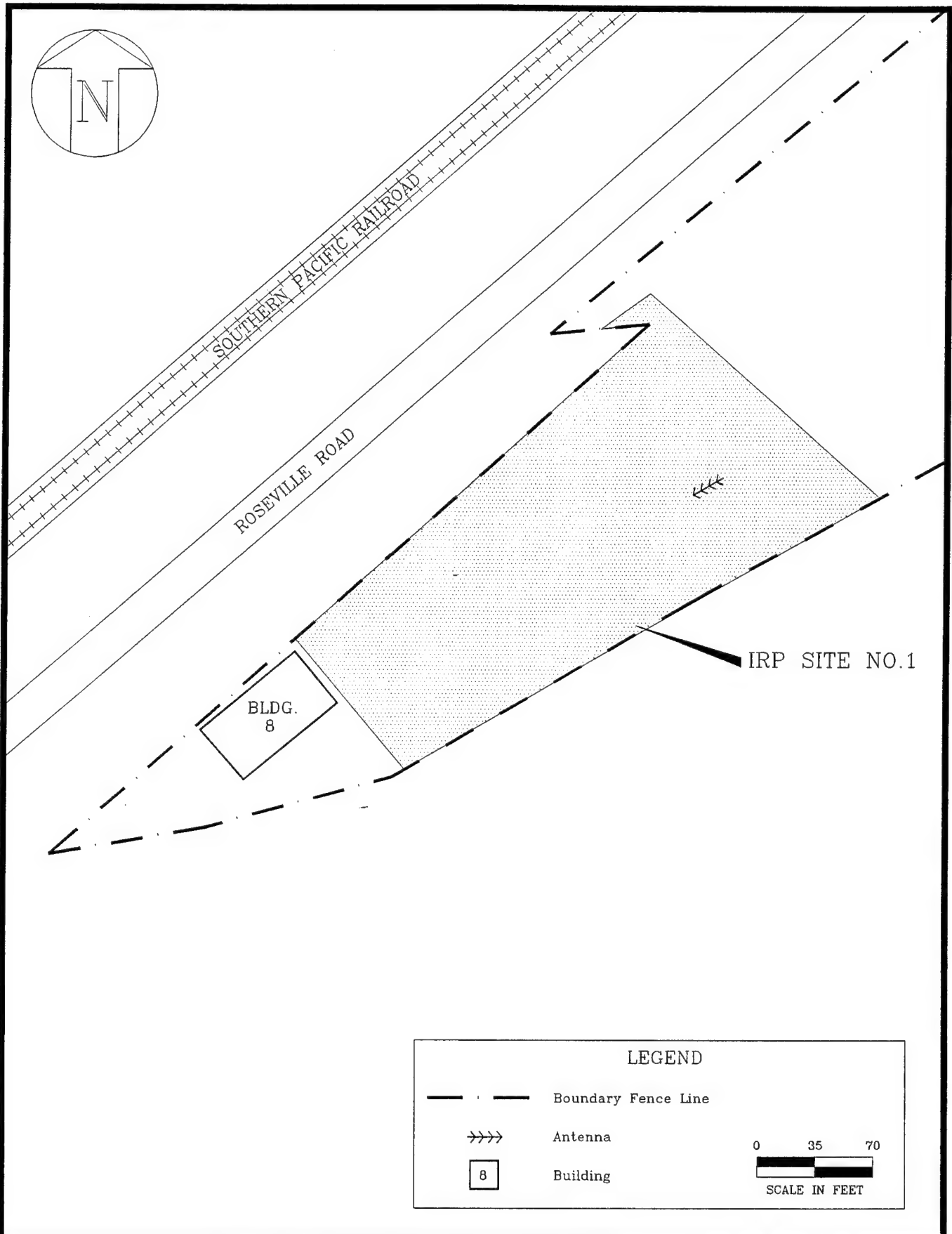


FIGURE 2.3

NORTH\NHGH4-3I

IRP SITE NO.1 SITE PLAN

162nd CCGP & 149th CCSQ

North Highlands ANG

Sacramento, California

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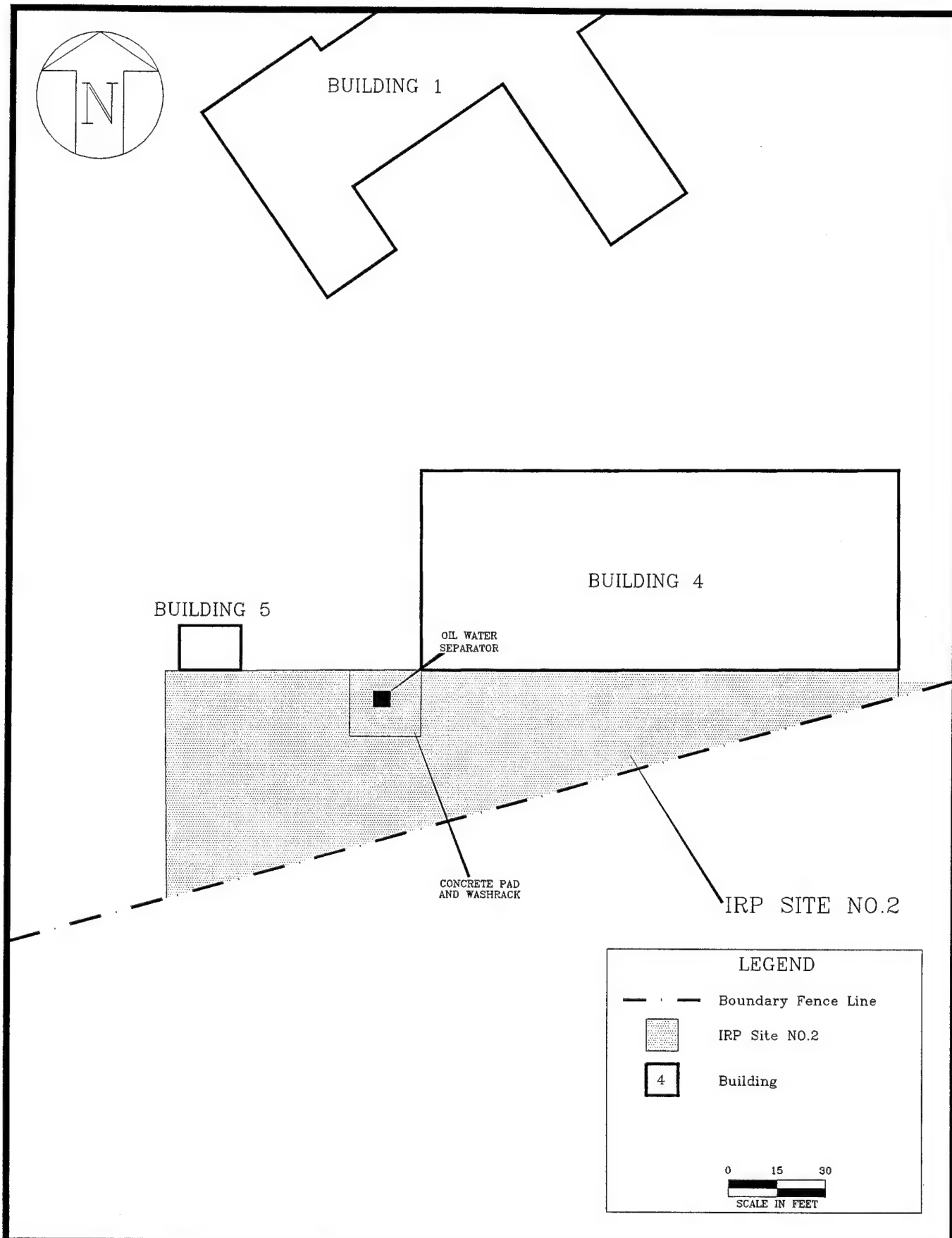


FIGURE 2.4

NORTH\NHGH4-4I

IRP SITE NO.2 SITE PLAN

162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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2.2.2.1 History of Activities

Small amounts of waste solvents, paints, and thinners were periodically poured along the boundary fence from the late 1950s through the mid-1960s. However, during this period, the boundary fence was not located in its current position, but was located approximately 8 feet behind and parallel to Building 4 (see Figure 2.5). Furthermore, a surface depression, which was then located south of the Station's property, received surface water runoff from the area behind the Vehicle Maintenance Shop. The majority of spills or releases of hazardous materials would also drain into this drainage area. However, when construction of Interstate 80 began in 1968, the Station's property line was moved to the south. Construction also resulted in the surface depression being filled. This move placed the drainage area within the Station's boundary as shown on Figure 2.5. After the fence line was moved to reflect the changed property line, the site was covered with asphalt when the parking area for the Vehicle Maintenance Shop was extended to the new fence line. During the installation visit conducted for the PA in April 1990, no noticeable soil staining or other visible signs of release were observed.

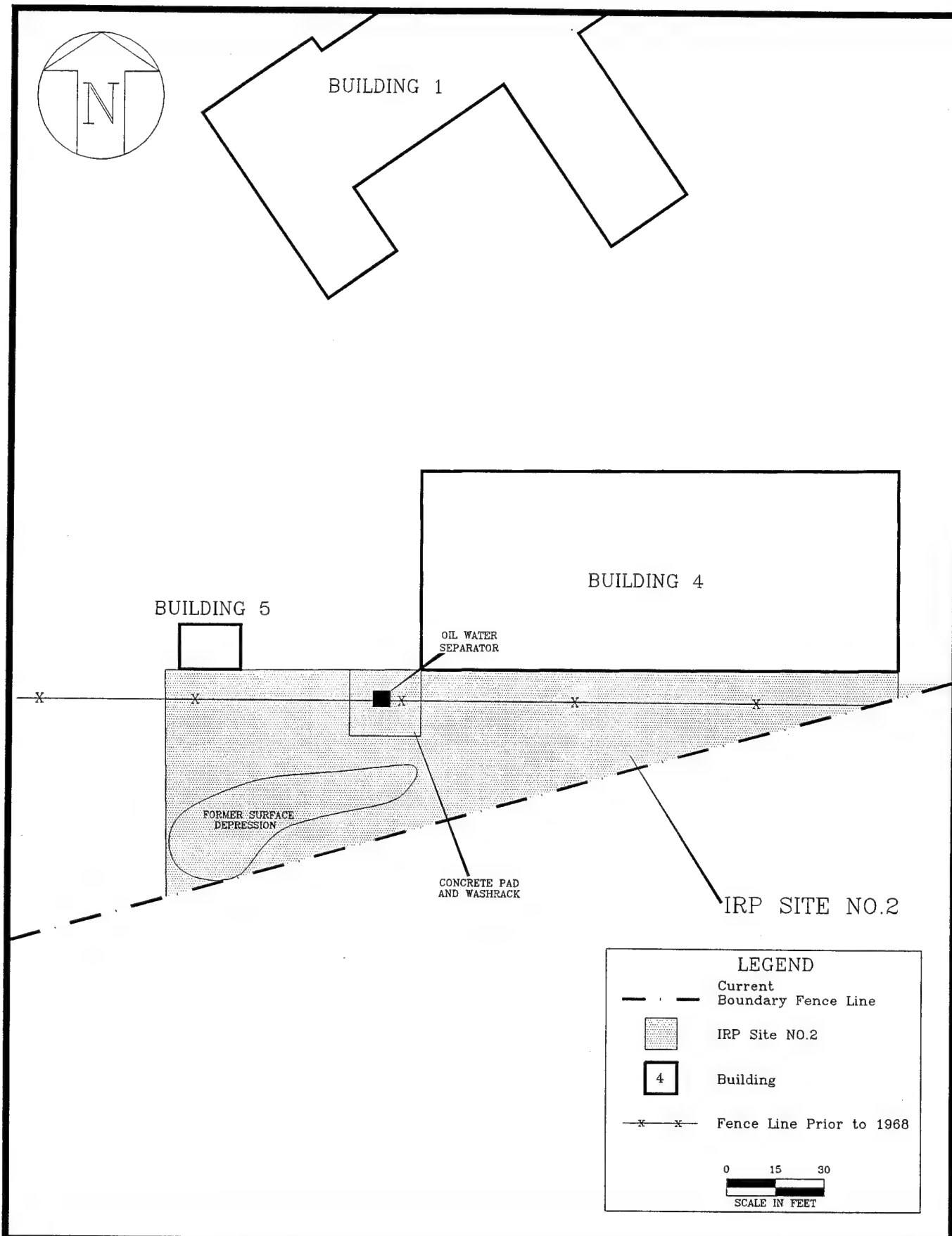


FIGURE 2.5

LOCATION OF PROPERTY AND FENCE
LINE PRIOR TO 1968
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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SECTION 3.0 ENVIRONMENTAL SETTING

The environmental setting of North Highlands ANGS is presented through discussions of physiography, climate, geology, soils, hydrogeology, surface water, and endangered fish and wildlife. These discussions incorporate both regional and local perspectives.

3.1 PHYSIOGRAPHY AND CLIMATE

North Highlands ANGS is located in Sacramento County in the northern one-third of the Central Valley of California, which is referred to as the Sacramento Valley. The Central Valley, trending in a north northwest to south southeasterly direction, extends from the Klamath Mountains near Redding for some 400 miles, with an average width of 50 miles. The valley is bordered on the east by the Sierra Nevada Mountains, on the west by the Coast Range Mountains, and to the south by the Tehachapi Mountains. Much of the area within the Valley is level and appears as a broad, open plain. North Highlands ANGS is located on relatively flat terrain with a surface elevation of 60 feet above mean sea level (MSL) with gentle slopes of less than 1 degree toward the west (see Figure 3.1).

The climate in the area of North Highlands ANGS is characterized by dry, hot summers and moist, cool winters. Relative humidity ranges from 60 to 90 percent in winter and 15 to 30 percent in summer. The amount of sunshine in January averages 44 percent (14 days) and increases gradually to more than 90 percent during June, July, and August. Prevailing southerly Pacific Ocean winds provide an annual temperature of 61.4° F. Monthly average temperatures range from 46.0° F in January to 76.1° F in July. Annual precipitation at the Station, based on a 29-year record from 1951-1980, averages 18.0 inches. Evapotranspiration in the Sacramento area is close to 45 inches per year, resulting in a net annual precipitation of -27 inches. Most of the yearly precipitation occurs during the period from October through April.

3.2 GEOLOGY

3.2.1 Regional Geology

As previously described, the Central Valley lies between two major mountain ranges in an asymmetrical, structural trough. Sediments in the trough range in age from Late Jurassic to Holocene and are predominantly the result of periods of uplift in the Sierra Nevada followed by erosion of these highlands to the valley floor. As much as ten vertical miles of sediment have

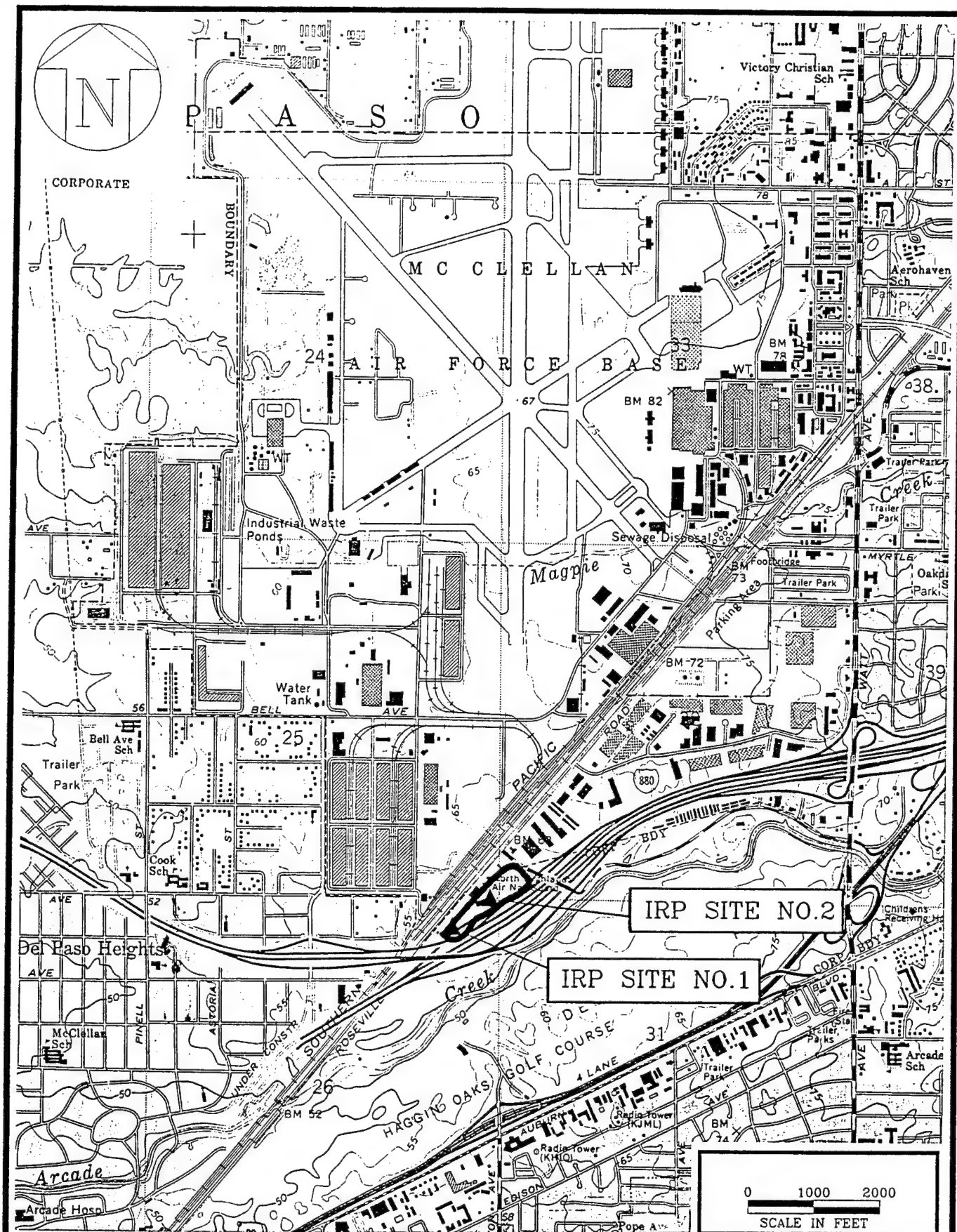


FIGURE 3.1

NORTH\NGHG1C0

USGS 7.5' TOPOGRAPHICAL
QUADRANGLE MAP
162nd CCGP & 149th CCSQ
North Highlands ANGS
Sacramento, California

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been deposited within this valley. Along the flanks of the valley, which correspond to the flanks of the trough, deposits are generally thinner.

The ancestral Sierra Nevada range was formed by tectonic processes including faulting, folding, volcanism, and igneous intrusion during the late Jurassic and early Cretaceous periods. During the early Cretaceous period, saltwater covered the present day Sacramento Valley. Large quantities of rock were eroded from the Sierra Nevada, transported by sediment-laden rivers, and deposited in the saltwater-filled basin. Deposition continued up to the early Eocene epoch. Following this depositional period, the sea regressed with the seashore migrating westward.

During the late Oligocene and early Miocene epochs, volcanic eruptions deposited rhyolitic material and ash throughout the Sierra Nevada. This material was then eroded and redeposited on the valley floor. Volcanic eruptions continued during the late Miocene and early Pliocene, with basaltic lava flows and andesitic mudflows that flowed down the slopes of the Sierra Nevada, rearranging pre-existing drainages, filling valleys, and depositing breccias and volcanic material. During this period of volcanic activity, the Sierra Nevada was slowly uplifted and tilted to the west, increasing stream gradients and erosion.

During the Pleistocene epoch, a series of four glacial and three interglacial periods occurred in the Sierra Nevada. During glacial periods, sea level decreased. The elevation at which streams entered the ocean was lowered, increasing stream velocities, which caused rivers and streams to cut deeper into older, less resistant deposits. During periods of glacial retreat, meltwater carrying boulders, gravels, sands, and mud flowed through stream channels and spread outward to cover broad floodplains.

During the Pliocene and Pleistocene epochs, a large complex system of alluvial fans formed along the base of the Sierra Nevada. Alluvial and fluvial deposits consisted mainly of continent-derived sediments, such as fine-grained sand, silt and clay. However, during periods of glacial advance, glacial flour was deposited on alluvial fans with coarse, sandy sediments deposited during glacial retreat.

Relatively little deposition has occurred during the Holocene epoch (the past 10,500 years). Unconsolidated gravel, sand, silt, and clay have been deposited along stream and river channels, on terraces, on floodplains adjacent to rivers, and in basins.

3.2.2 Local Geology

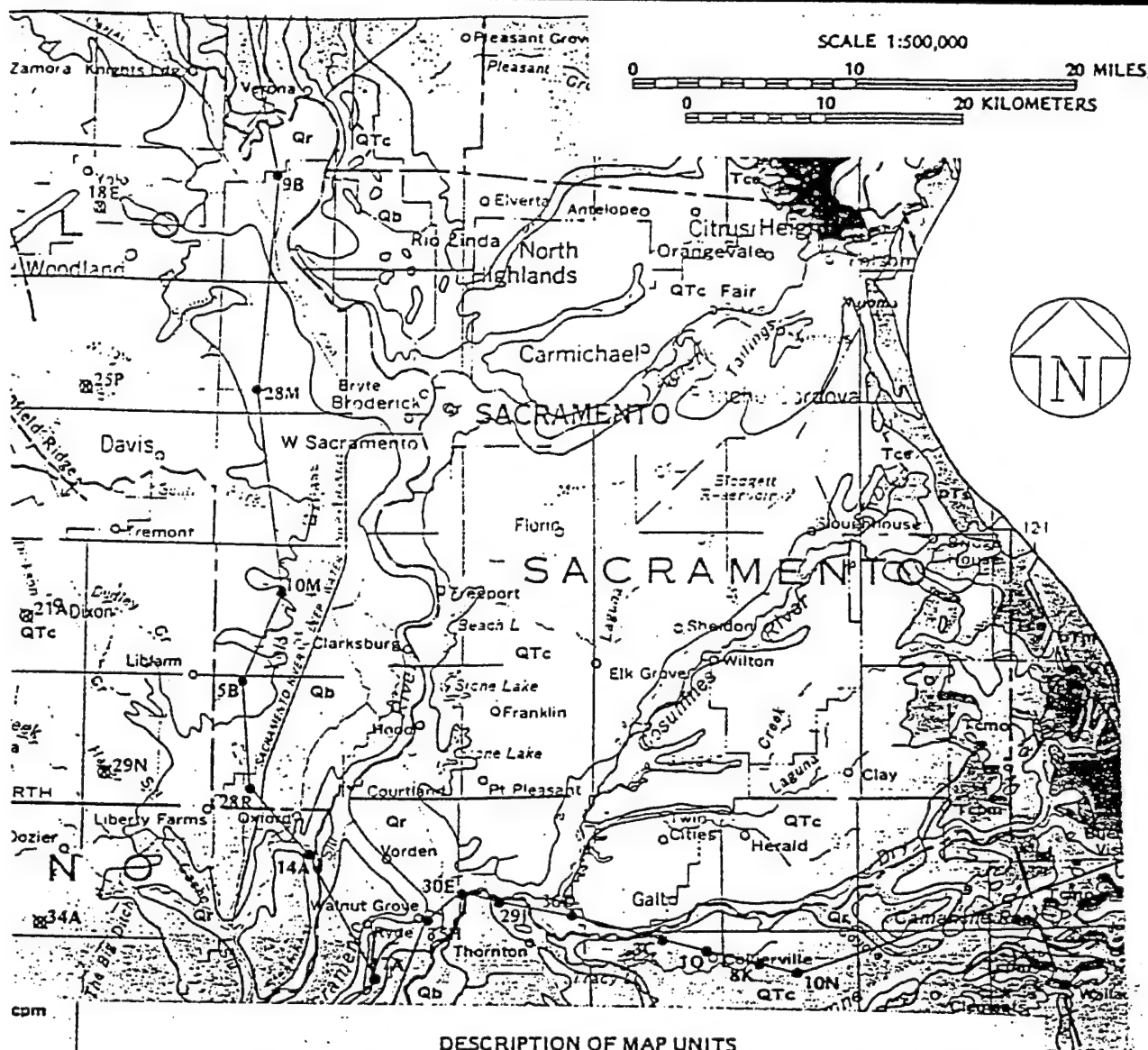
A very complex fluvial environment was created in the vicinity of North Highlands ANGS by the variation in climatic conditions and the sediment generated by successive periods of glaciation during the Pliocene and Pleistocene epochs in the Sierra Nevada. The geologic sequence is a series of gently sloping alluvial plain sediments that consist of channel fills, sand bars, oxbow lake deposits, and widespread flood deposits. As a result of the processes occurring in the alluvial environment, deposits consisting of any one lithologic type are limited in horizontal and vertical extent. Coarse deposits may grade laterally into fine deposits, and fine into coarse across short distances (less than 25 feet). The interbedded and gradational deposits that are formed are heterogeneous in grain size distribution, texture, porosity, and permeability over short distances. Although individual beds are discontinuous, some deposits may locally occur adjacent to or overlying deposits of similar porosity and permeability. A geologic map of the Sacramento Valley is presented as Figure 3.2.

San Joaquin sandy, loamy soils at North Highlands ANGS are underlain by approximately 3,000 feet of Miocene to Holocene continental sediments (see Figure 3.3). The Mehrten Formation is the oldest identified Miocene formation underlying the North Highlands ANGS area. It consists of a lower unit of water-transported, dense, hard, gray volcanic tuff-breccia and an upper unit of fluvially deposited black, well-sorted, biotite-rich sand interbedded with blue to brown clay. The thickness of the Mehrten Formation varies between 200 and 1,200 feet.

The Laguna Formation unconformably overlies the Mehrten Formation, and is characterized by a heterogeneous assemblage of arkosic (feldspar rich), tan-to-brown beds of silt, clay, and sand with gravel lenses. The Laguna Formation ranges from 125 to 200 feet in thickness.

The Turlock Lake Formation unconformably overlies the Laguna Formation and consists largely of arkosic fine sand and silt with clay near its base grading upward into coarse sand. The sand and gravel beds are typically massive, lenticular, and difficult to trace laterally. The thickness of the Turlock Lake Formation ranges from 0 to 225 feet.

The Riverbank Formation overlies the Turlock Lake Formation. The formation is a heterogeneous assemblage of fluvial deposits consisting primarily of sand, with interbedded fine sand and silt, and scattered pebble and gravel lenses. The fluvial and alluvial deposition of these sediments have resulted in laterally and vertically discontinuous lithologic units. The Riverbank Formation ranges from 0 to 100 feet in thickness.



- Qs** Sand dunes (Holocene) Windblown sand and dune sand
- Qb** Flood-basin deposits (Holocene) Clay, silt, and some sand deposited during flood stages of major streams; in delta area, include mud, muck, loam, and sand. In places may include part of the Modesto Formation (Pleistocene)
- Qr** River deposits (Holocene) Gravel, sand, silt, and minor amounts of clay deposited along channels, flood plains, and natural levees of major streams. In places may include part of the Modesto Formation (Pleistocene)
- QTc** Continental rocks and deposits (Pliocene to Holocene) Heterogeneous mix of generally poorly sorted clay, silt, sand, and gravel; some beds of claystone, siltstone, sandstone, and conglomerate. Include some informal units: younger alluvium (Holocene), older alluvium (Pleistocene and Holocene?), and conglomerate (Pleistocene); four formations of Pleistocene age: Red Bluff, Modesto, Riverbank, and Turlock Lake; the Tehama Formation (Pliocene and Pleistocene) on western side of valley, and the Laguna Formation (Pliocene) on eastern side. Difficult to determine subsurface contacts of formations and informal units
- QTvr** Volcanic rocks and deposits at Sutter Buttes (Pliocene and Pleistocene) Tuff and tuff breccia
- QTv** Volcanic rocks (Pliocene and Pleistocene) Andesitic and rhyolitic porphyry and tuff at core of Sutter Buttes

SOURCE: USGS, 1986, (MODIFIED).

FIGURE 3.2

GEOLOGIC MAP OF THE
SACRAMENTO VALLEY, CALIFORNIA
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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SACRAMENTO VALLEY (Dimstead and Davis, 1961)				SAN JOAQUIN VALLEY		
	West Side	Northeast Side	East Side	Mokelumna Area (Piper and others, 1939)	Stanislaus Area (Davis and Hall, 1959)	West and South Sides (Various authors)
RECENT	River, flood-basin, and alluvial-fan deposits (0-150+ ft.)	River and alluvial-fan deposits (0-150+ ft.)	River and flood-basin deposits (0-100 ft.)	River-channel and flood-plain deposits (0-25 ft.)	River-channel and flood-plain deposits (0-25 ft.)	Alluvial-fan, flood-plain and flood-basin deposits (0-150+ ft.)
PLEISTOCENE	Red Bluff Formation (0-50± ft.)	Victor Formation and related deposits (0-100± ft.) Fanglomerate from the Cascade Range (0-500+ ft.)	Victor Formation (0-150+ ft.) Laguna Formation and related continental deposits (0-1,000+ ft.)	Victor Formation and related deposits (0-150 ft.)	Modeste Fin of Davis and Hall, 1959 (50-100 ft.) Riverbank Formation of Davis and Hall, 1959 (350-850 ft.)	Corcoran Clay Member b. 0.6(+) \times 10 years Tulare Formation (0-3,000 ft.)
PLIOCENE	Tehama Nomlaki Tuff Member a. 3.3 \times 10 ⁶ years Formation (0-2,500+ ft.)	Tuscan Formation (0-1,000+ ft.)	Mehrten Formation and related Volcanic rocks (0-400 ft.)	Laguna Formation (0-400 ft.) Mehrten Formation (75-400 ft.)	Mehrten Formation (800-1,200 ft.)	San Joaquin Formation (0-1,800 ft.) Etchegohn Formation (0-2,000 ft.)
MIOCENE						

a. Evernden and others, 1964

b. Janda, R. J. 1965, p.131

SOURCE: POLAND AND EVENSON, HYDROLOGY AND LAND SUBSIDENCE: GREAT CENTRAL VALLEY, CALIFORNIA, p.241, 1966.

FIGURE 3.3

NORTH\NHGH4-7G

GENERALIZED STRATIGRAPHIC
COLUMN OF THE AREA
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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3.3 SOILS

The soil at North Highlands ANGUS is of the San Joaquin association which is a moderately shallow sandy loam that occurs on gentle slopes (3 to 8 percent) in old valley plains cut by small drainageways. The surface soil has an average thickness of 6 inches and is a light brown or reddish brown, strongly to medium acid sandy loam that dries out moderately hard. The upper subsoil extends to depths of 12 to 30 inches and is a light clay loam, slightly more acid than the surface soil. The deeper subsoil is a reddish-brown or brown, compact clay that becomes more gray with depth and then turns olive-gray immediately above the impervious hard pan layer which varies in depth from 15 to 42 inches below land surface (BLS). Surface soil permeability is moderate (4.45×10^{-4} centimeters per second (cm/sec) to 1.41×10^{-3} cm/sec), but subsoil/substratum permeability is very low (less than 4.24×10^{-5} cm/sec). Erosion hazard is slight. The information pertaining to soil was derived from the Soil Survey of Sacramento Area, California (U. S. Department of Agriculture, Soil Conservation Service, Series 1941, No. 11, August 1945).

3.4 HYDROLOGY

3.4.1 Hydrogeology

Aquifers containing fresh groundwater are principally heterogenous, unconsolidated, continental deposits (primarily alluvium). The lower unit of the Mehrten Formation yields little water due to the impermeable nature of the tuff-breccia and many of the clay beds. Much of the water is in a state of semi-confinement. Conversely, the upper unit yields large quantities of potable groundwater and is a primary source for many public supply wells.

Fine-grained beds of the Laguna Formation yield only moderate quantities of groundwater. Soft, sandy beds of well-sorted granitic material yield high quantities of groundwater. The water-bearing characteristics of the Turlock Lake Formation are similar to the Laguna Formation.

The Riverbank Formation is one of the most important water-bearing formations for domestic and shallow irrigation wells, and is generally more permeable than the Laguna Formation. However, because of decreasing water levels and increased demands on groundwater, wells must tap deeper formations to obtain reliable amounts of groundwater.

In the Sacramento Valley, water for irrigation, public supply, and industry is obtained primarily from surface water sources and, in part, from wells. These wells, in general, range in depth from 100 to 500 feet BLS. Original data on water wells drilled in the 1950s in the area of the Station found water levels at average depths of 40 feet BLS at the time of drilling. Groundwater elevation measurements by the Water Resources Division (County of Sacramento) for Spring 1989, indicate that the groundwater elevations in the vicinity of the Station are now approximately 100 feet BLS (40 feet below MSL). Therefore, since the 1950s, multi-use withdrawals have lowered water levels approximately 60 feet in the greater metropolitan Sacramento area creating a cone of depression that underlies the Station. Groundwater flow in the area of the Station is generally from northeast to southwest (see Figure 3.4). There are over 120 drinking water wells within four miles of the Station. Within one mile of the Station there are 17 drinking water wells. Additional data on drinking water wells and location maps are included in Appendix F (pages F-1 to F-3).

3.4.2 Surface Water

North Highlands ANGS is located in the Sacramento/American River drainage basin approximately five miles east (up river) of the intersection of the Sacramento and American Rivers. Surface flow off the facilities is through storm drains and/or directly into open ditches flowing westward into Arcade Creek (see Figure 3.5). Arcade Creek flows toward this intersection. Figure 3.6 shows the areal drainage in the vicinity of North Highlands ANGS which has been classified as being outside the 100-year flood plain. Further data on surface water and drainage routes are contained in Appendix F (pages F-2 to F-6).

3.5 CRITICAL HABITATS/ENDANGERED OR THREATENED SPECIES

According to records maintained by the California Department of Fish and Game Natural Diversity Database, no endangered or threatened species of flora or fauna have been identified within a one-mile radius of the Station (Science and Technology, Inc., 1991). There are approximately 123.7 acres of wetlands within 4 miles of the site.

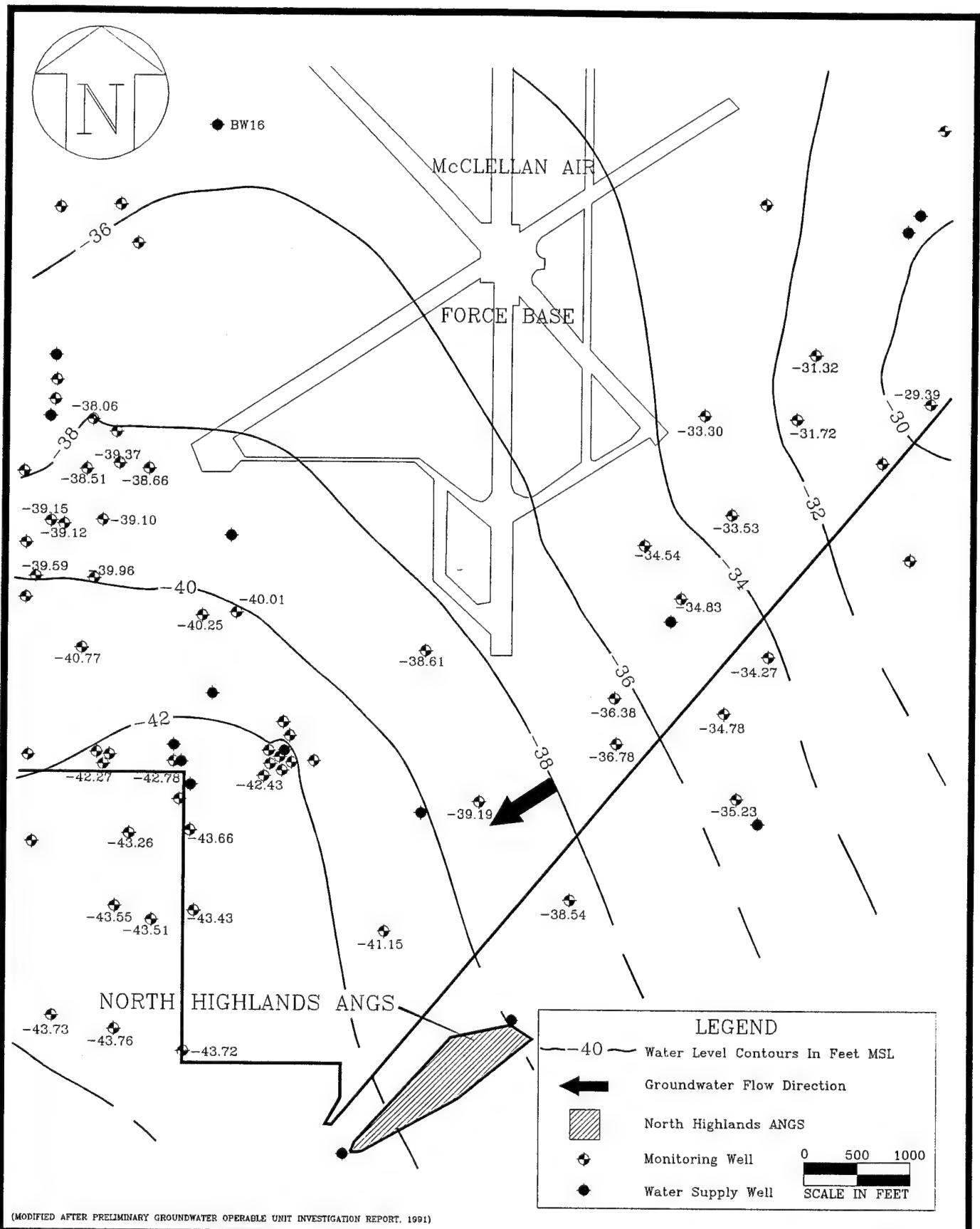


FIGURE 3.4

NORTH\NHGH4-8P

POTENTIOMETRIC SURFACE MAP
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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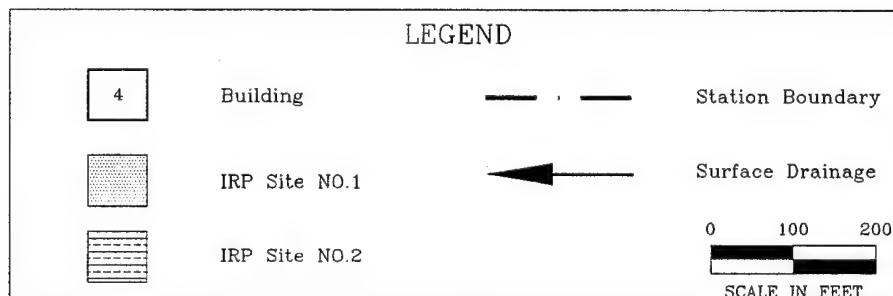
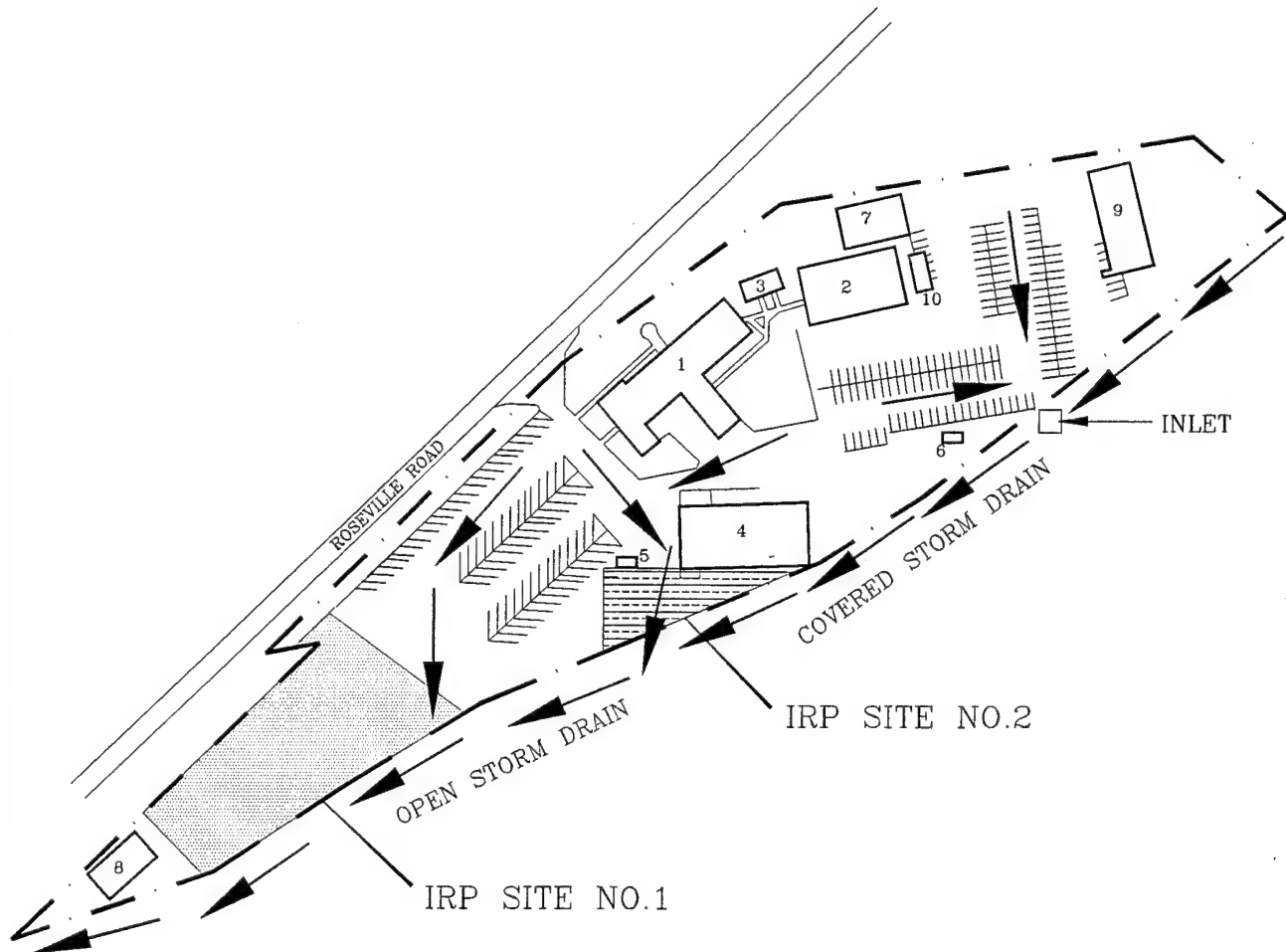
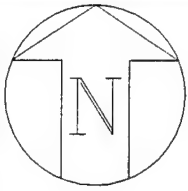


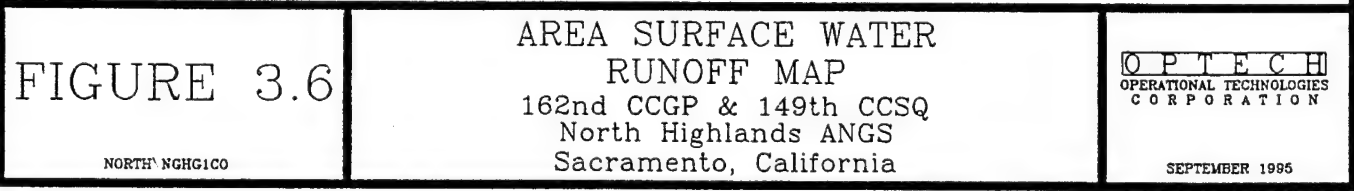
FIGURE 3.5

SURFACE WATER DRAINAGE MAP
 162nd CCGP & 149th CCSQ
 North Highlands ANG
 Sacramento, California

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NORTH\NHGH4-9S

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SECTION 4.0 FIELD PROGRAM

The purpose of this SI was to confirm the presence or absence of contamination at IRP Site No. 1 and IRP Site No. 2, to attempt to determine the areal extent of any contaminants detected, and to provide data needed to reach a decision point for the sites. This section describes the field activities performed during the SI to accomplish the above objectives, and the methodologies used to conduct these activities. The field investigation at North Highlands ANGTS commenced on 20 June 1994 and was completed on 29 June 1994.

4.1 GENERAL INVESTIGATION APPROACH

The field investigation at North Highlands ANGTS used the installation of soil borings in order to:

- Collect soil vapor samples at each site;
- Collect soil data at each site;
- Determine background soil conditions; and
- Collect a groundwater sample.

Soil borings were installed to determine whether contamination exists at each site, and if it does exist, to attempt to determine the nature and extent of the contamination. Soil vapor samples were collected from each soil boring as a screening tool to aid in the selection of soil samples to be submitted for laboratory analysis. In addition, soil vapor and soil samples collected from a specifically located soil boring established background conditions applicable to the Station. A sample was collected from the water table in an attempt to determine the presence of groundwater contamination.

4.2 DEVIATIONS FROM THE WORK PLAN

There were deviations from the Work Plan. However, all stages of the data quality objectives (DQOs), as outlined in Section 8.0 of the Work Plan, were met during the Site Investigation. Field screening and sampling procedures were carried out in accordance with the Work Plan. Additional DQOs included field personnel health and safety considerations, equipment calibration and decontamination, and completeness of appropriate documentation. Deviations from the Work Plan in no way affected the DQOs.

The deviations from the Work Plan are described as follows:

- A photoionization detector (PID), rather than a flame ionization detector (FID), was used to field screen soil samples collected during sampling.
- The analytical program for soil vapor samples was expanded to include the analysis of halogenated volatile hydrocarbons by method SW8010. Halogenated volatile hydrocarbons had been detected in soil samples collected from monitoring well MW-1075, drilled on ANG's property by McClellan AFB.
- Soil samples collected during this investigation were not all analyzed for priority pollutant metals by the same analytical method. Some soil samples were analyzed for priority pollutant metals, with the exception of mercury and selenium, by method SW6020 rather than methods SW6010 and SW7000 series, as specified in the Work Plan. Method SW6020 is Resource Conservation and Recovery Act (RCRA) approved and attains comparable to lower reporting limits than those of methods SW6010 and SW7000. Other soil samples were analyzed using method SW6010, but SW7000 series, with the exception of mercury, nickel, and selenium, were not used as specified in the Work Plan. Samples were analyzed by method SW6010 when laboratory equipment used for method SW6020 malfunctioned and repairs could not be made in a timely fashion. Consequently, soil samples analyzed by method SW6010 reflect higher reporting limits due to limitations of that method.
- A groundwater sample was not collected from boring BH02-04, as specified in the Work Plan. A bailer was used to collect a sample, designated as BH02-04-GW-105', from boring BH02-04 from the water table, however, the high silt content of the sample (90% visually in the bottles) precluded it from being analyzed as a water sample. Filtering was not considered a feasible option by the contract laboratory, and the sample was subsequently analyzed as a solid.
- Investigation derived wastes were drummed in steel 55-gallon drums which were not plastic-lined, as specified in the Work Plan.
- Soil borings were grouted at the conclusion of field activities rather than immediately after sampling had been completed, as specified in the Work Plan.

4.3 FIELD SCREENING ACTIVITIES

4.3.1 Soil Vapor Sampling

Soil vapor sampling was conducted in each soil boring installed during this investigation. Soil vapor sampling was used to characterize the nature and extent of halogenated volatile hydrocarbons; benzene, toluene, ethylbenzene, and xylenes (BTEX); and total petroleum hydrocarbons (TPH) contamination in the subsurface. The results were used as a screening tool to aid in the selection of soil samples to be submitted for laboratory analysis.

Soil vapor samples were collected and analyzed by Transglobal Environmental Geochemistry (TEG), Sacramento, California. A total of 62 soil vapor samples were collected: 28 from IRP Site No. 1, 28 from IRP Site No. 2, and six from the background soil boring.

Soil vapor samples were collected at ten-foot intervals to provide multiple depth vapor profiling. Once the augers had been advanced to the desired sampling depth, a probe, fitted with tygon tubing and a notched point, was driven to a depth one-foot below the drilled depth. Once the desired sampling depth was reached, soil vapor was withdrawn from the tygon tubing using a small calibrated syringe connected to an on-off valve. The first three dead volumes of the sample tube were discarded to flush the tube and fill it with *in situ* soil vapor. The next 20 cubic centimeters of vapor were withdrawn in the syringe, the syringe plugged, and the sample immediately transferred to the on-site California Department of Health Services (DHS)-certified mobile laboratory (CERT #1671) for analysis within minutes of collection. Soil vapor samples were analyzed for halogenated volatile hydrocarbons, BTEX, and TPH using United States Environmental Protection Agency (USEPA) methods SW8010, SW8020, and SW8015 Modified, respectively. Three field duplicates were collected to provide a quality assurance check on analytical procedures and results. Soil vapor sampling results are fully discussed in Section 5.0 and included in Appendix A.

4.3.2 Soil Screening

During soil sampling of soil borings, the air around the sampler was monitored with a Photovac HL MicroTip PID immediately upon opening the sampler (to maximize the detection of volatiles). The PID was calibrated at the start of each day using 100 parts per million (ppm) isobutylene gas. Soil was then field screened using a Photovac 10S55 Portable Gas Chromatograph (GC). The GC, calibrated to screen for BTEX, was used to detect and quantify the presence of these compounds in the headspace from the soil samples collected. The GC was

standardized prior to use each day using a 1 ppm BTEX headspace standard which was prepared fresh daily by diluting a 2,000 ppm BTEX stock solution. The soil samples collected were placed in plastic bags, and the PID used to screen the headspace for photoionization compounds. All PID readings are indicated on the boring logs included in Appendix B. Once the soil sample for laboratory analysis had been prepared, ambient temperature headspace analysis (ATHA) was conducted for the remaining soil. The remaining soil was placed in a plastic bag for 15 minutes and allowed to reach ambient air temperature. After 15 minutes, a headspace reading was collected using the field GC. Headspace analysis was used as a tool to determine which sample intervals best characterized the environment of the borehole or demonstrated the highest headspace reading. Data obtained from the field GC and PID were used to determine which soil samples were sent to the laboratory for analytical analysis and to provide qualitative data on those samples not sent.

Field GC data is summarized in Section 5.0, and included in Appendix C.

4.4 CONFIRMATION ACTIVITIES

Tonto Environmental Drilling, Sacramento, California, was retained as the contractor for drilling soil borings. The selected drilling contractor mobilized personnel and equipment that met or exceeded North Highlands ANGS and State of California requirements.

Core Laboratories, Anaheim, California, was retained to perform chemical analyses. Provisions were made for proper sample containers, labels, chain-of-custody forms, sample stabilization and preservation, insulated sample shipping containers, and packing materials.

Hunter Surveying, Inc., Orangevale, California, was retained as the surveying contractor. The site boundaries, buildings, and all soil boring locations were surveyed. The land surface elevation of each soil boring is shown on the borehole logs included in Appendix B.

4.4.1 Soil Borings

Soil borings were installed to obtain both soil vapor and soil samples for analytical laboratory analysis for defining any existing soil contamination; to aid in defining the vertical and horizontal extent of detected contaminants at the sites; to establish background soil conditions; and to obtain a groundwater sample at the water table to determine the presence of groundwater contamination. Soil samples were also used for determining site geology and subsurface soil characteristics.

Soil borings were drilled by using hollow stem auger (HSA) methods. The HSA drilling method employs a hollow helical steel drill tool that is rotated to advance the boring and lift formation materials (cuttings) to the surface. The flights for the HSA are welded onto steel pipe and a cutter head is attached to the "lead" (bottom) auger to cut the hole. During drilling, a center bit is inserted into the hollow area of the cutter head that prevents cuttings from re-entering the hollow portion of the auger. Generally, the center bit is flush with or extends no more than 1/2 foot below the cutter head. The center bit connects through the auger flights by small diameter drill rods and is attached to the top-head drive unit of the drill rig. The top-head drive is powered by a truck-mounted engine that mechanically rotates the entire flight of augers. The hollow opening allows the insertion of sampling tools (i.e., California-style sampler) with the augers in place to prevent caving of the borehole. Auger flights, drill rig, and tools were thoroughly steam-cleaned in the designated decontamination area southwest of Building 5 before initial use and after the completion of each soil boring.

A total of 10 soil borings: five located at IRP Site No. 1, four located at IRP Site No. 2, and one background, were installed for data collection. All work was performed in a manner consistent with State of California laws and regulations. All soil borings were installed to a depth of 60.0 feet BLS, with the exceptions of borings BH02-01 which was drilled to a depth of 63.5 feet BLS and BH02-04 which was installed to a depth of 110.5 feet BLS. Soil samples were collected at five-foot intervals for subsurface characterization and field screening. An 18-inch carbon steel California-style sampler equipped with three 6-inch brass sleeves was used for collecting a minimum of two soil samples for laboratory analysis from each soil boring. One sample was collected from the bottom of each borehole and the selection of the second sample was based on soil vapor and field screening results (highest PID and field GC readings), as well as visual observations. Four additional investigative soil samples, one from IRP Site No. 1 and three from IRP Site No. 2, were collected for laboratory analysis. The additional soil samples were also selected based on soil vapor and field screening results, as well as visual and olfactory observations. Actual sample depths submitted for laboratory analysis are discussed in Section 5.0 and shown on the borehole logs included in Appendix B. The California-style sampler was decontaminated and new, decontaminated brass sleeves inserted before each sampling event.

Borehole abandonment activities conformed to State of California and the Sacramento County Environmental Management Department (Hazardous Materials Division) requirements. Borings were backfilled with cement grout at the conclusion of field activities. Borings were cement grouted from the bottom of the borehole to the surface using a tremie pipe.

Soil boring coordinates and ground elevation at each site were determined by a professional surveyor.

4.4.2 Specific Media Sampling

This subsection summarizes the analytical program followed for soil samples collected during the site investigation to determine the nature, magnitude, and extent of contamination detected at the sites. Also included in this subsection is a discussion of quality control procedures followed during the field sampling activities.

4.4.2.1 Soil

Past activities indicated that suspected contamination at IRP Sites No. 1 and No. 2 consisted primarily of waste oils, solvents, fuels, paints, and/or thinners. Therefore, the primary analytical program for the investigation focused on the detection of volatile organic compounds (VOCs) using method SW5030/SW8240; semivolatile organic compounds (SVOCs) by method SW3550/SW8270; priority pollutant metals by either method SW3050/SW6020 or SW3050/SW6010, with the exception of mercury (SW3050/SW7471) and selenium (SW3050/SW7742); TPH both as gasoline and as diesel by method SW5030/SW3550/SW8015 Modified; and oil and grease (O&G) by Standard Method (SM) 5520 C.

Table 4.1 summarizes the analytical program at each site.

4.4.2.2 Quality Control of Field Sampling

Field duplicate samples, field blanks, and trip blanks were submitted to the analytical laboratory for assessment of the quality of data resulting from the field sampling program. Field and trip blank samples were analyzed to check for procedural contamination and ambient conditions at the site that may have caused sample contamination. Duplicate samples were submitted to provide a quality assurance check on analytical procedures and results.

The level of the quality control effort included one field duplicate and one field blank for every 10 or fewer investigative soil samples. One VOC analysis trip blank, consisting of distilled, deionized, ultra pure water, was included along with each shipment of samples. One matrix spike/matrix spike duplicate was collected for every 20 or fewer investigative soil samples. Matrix samples provide information about the effect of the sample matrix on the analytical methodology.

Table 4.1
Laboratory Analyses Summary Table
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Site Location	Matrix	Field Parameters	Lab Parameters & Test Methods	Investigating Samples	Number of Field QA/QC Samples					Matrix Totals
					Trip Blanks	Equipment Blanks	Field Blanks	Field Duplicate	MS/MSD	
IRP Site No. 1	Soil (Subsurface)	Field Screening using Field GC/PID Soil Classification	VOCs/SW8240 SVOCs/SW8270 TPH/SW8015 Mod. Metals/SW6020 ^a /SW6010 ^b O&G/SM5520C	11	3*	1*	1	1	1	14
				11			1	1	1	14
				11			1	1	1	14
				11			1	1	1	14
				11			1	1	1	14
IRP Site No. 2	Soil (Subsurface)	Field Screening using Field GC/PID Soil Classification	VOCs/SW8240 SVOCs/SW8270 TPH/SW8015 Mod. Metals/SW6020 ^a /SW6010 ^b O&G/SM5520C	11	4*	2*	1	2	1	15
				11			1	2	1	15
				11			1	2	1	15
				11			1	2	1	15
				11			1	2	1	15
Background	Soil (Subsurface)	Field Screening using Field GC/PID Soil Classification	VOCs/SW8240 SVOCs/SW8270 TPH/SW8015 Mod. Metals/SW6020 ^a O&G/SM5520C	2	1*	1*	1			3
				2			1			3
				2			1			3
				2			1			3
				2			1			3

GC - Gas Chromatograph.

*Trip and Equipment Blanks are not counted in Matrix Totals.

QA/QC - Quality Assurance/Quality Control.

MS/MSD - Matrix Spike/Matrix Spike Duplicate.

VOCs - Volatile Organic Compounds.

SVOCs - Semivolatile Organic Compounds.

PID - Photoionization detector.

TPH - Total Petroleum Hydrocarbons.

O&G - Oil and Grease.

^aWith the exception of mercury (SW7471) and selenium (SW7742).

^bWith the exception of mercury (SW7471), selenium (SW7742), and nickel (SW7520).

Soil Sample Preservation

Soil samples submitted for laboratory analysis collected with a California-style sampler were contained in brass sleeves. Immediately upon removal from the sampler, the sleeve ends were covered with a teflon barrier, aluminum foil, and fitted with a plastic cap. Prepared samples were placed in a sealed zip-lock plastic bag and immediately placed on ice within an ice chest and maintained at a temperature of 4° C.

Water Sample Preservation

VOC and TPH samples were preserved with no more than 2 drops of a 1:1 solution of hydrochloric acid per 40-milliliter glass vial having a teflon-lined lid. SVOC samples were stored in a 1-liter amber glass bottle having teflon-lined lids, and no preservatives. Total recoverable metal samples were stored in a 1-liter high density polyethylene bottle with a teflon-lined lid, and preserved with a solution of 1:1 nitric acid to achieve a pH of less than 2. Oil and grease samples were stored in a 1-liter amber glass bottle having teflon-lined lids, and preserved with sulfuric acid.

4.5 INVESTIGATION DERIVED WASTE

During the SI, a certain amount of waste material (personal protective equipment (PPE), drill cuttings, and decon water) were produced as a result of investigative activities. Drill cuttings were produced during the installation of soil borings. Drill cuttings were preliminarily characterized by monitoring for organic vapor emissions with a Photovac HL MicroTip PID and screening with a Photovac 10S55 Portable GC. All soil cuttings from each drilling location were drummed separately in steel, 55-gallon drums at the time of drilling. Additionally, all decon pad water was drummed in steel, 55-gallon drums. All drums were properly marked to indicate their contents, the collection date, contractor's name and phone number, and borehole identification number. Guidance for the final disposition of drummed materials is provided in this section.

Miscellaneous derived wastes (e.g., gloves, visqueen sheeting, and wipes) were disposed in a general refuse container because they had not come in contact with drill cuttings having PID readings in excess of 100 ppm, when field screened as described in Subsection 4.3.2.

Fifty-two drums containing drill cuttings and two drums containing decon water were accumulated during the SI. Soil cuttings for each drilling location were drummed separately. Table 4.2 lists the drilling locations for which drums were accumulated during the SI, the recommended disposition of those drums, and the rationale for each recommendation.

Drums marked "Soil" which can be disposed on-site should be evenly distributed over the surface in a manner to avoid mass loading of silt in surface runoff. Additionally, the soil should not be distributed adjacent to drainage ditches. Metals were the only analytes detected in soil samples collected during the SI. Disposed in this manner, metals are expected to have an average degree of environmental attenuation and should not affect groundwater or surface water quality. Water contained in drums marked "Decon Water" can be disposed into the oil/water separator.

Table 4.2
Recommended Disposition of Drums
162nd CCGP and 149th CCSQ, North Highlands ANGS, Sacramento, California

Drilling Location ID Number	Recommended Disposition	Rationale
BGBH-01	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH01-01	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH01-02	TCLP should be run for cadmium.	Cadmium exceeded estimated TCLP regulatory levels*.
BH01-03	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH01-04	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH01-05	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
Site No. 1 Composite	Disposition based on TCLP results from boring BH01-02.	No analytes from IRP Site No. 1 exceed estimated TCLP regulatory levels*, with the exception of cadmium in borehole BH01-02.
BH02-01	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH02-02	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH02-03	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
BH02-04	Soil can be disposed on-site.	No analytes exceed estimated TCLP regulatory levels. * Concentrations of analytes for which TCLP regulatory levels do not exist were approximately the same or on the same order of magnitude as background concentrations.
Decon Water	Water can be disposed in oil/water separator.	No analytes in soil exceed estimated TCLP regulatory levels*, with the exception of soil from boring BH01-02. Cadmium concentrations would be greatly diluted.

TCLP -- Toxic Characteristic Leaching Procedure.

*Estimated TCLP regulatory level -- Analyte concentrations are compared to 20x the TCLP regulatory level, which represents an estimate of the minimum concentration of the analyte which would have to be present in the soil for TCLP analysis to lead to a positive result.

5.0 INVESTIGATIVE FINDINGS

5.1 STATION-WIDE GEOLOGIC AND HYDROLOGIC INVESTIGATION RESULTS

Yellowish-brown to reddish-gray silt and sandy silt, with scattered seams of fine- to medium-grained sands, were generally encountered from surface to a depth of 36.0 feet BLS; yellowish-brown to reddish-gray silty to medium-grained sand from 36.0 to 46.0 feet BLS; and yellowish-brown to olive brown silt, with scattered seams of silty to medium-grained sands, to a depth of 110.5 feet BLS in soil borings drilled during the SI. Saturated conditions were encountered at a depth of 109.0 feet BLS. Geologic cross-section A-A', depicting the subsurface geology, is indexed on Figure 5.1 and shown in Figure 5.2.

5.2 BACKGROUND SAMPLING RESULTS

5.2.1 Background Sampling Location

Background data at North Highlands ANGS consisted of one soil boring, BGBH-01, which was used to obtain both soil vapor and soil samples. Soil boring BGBH-01 is located approximately 115 feet southeast of Building 10, 140 feet southwest of Building 9, and 320 feet northeast of IRP Site No. 2, as indicated on Figure 5.1. Soil boring BGBH-01 was relocated during the SI because it was near monitoring well MW-1075, installed on ANGS property by McClellan AFB. MW-1075, in which solvents were detected in the vadose zone, is located near the northern boundary of the Station. While conducting the SI fieldwork, the background boring was relocated near the southern boundary of the Station, an area not believed to be impacted by known or suspected sources of contamination.

Soil samples were collected for laboratory analysis from background soil boring BGBH-01 to determine naturally occurring concentrations, and contaminant or chemical concentrations already existing in the area due to general environmental conditions. Analytical results obtained during this sampling represent background conditions against which contaminant concentrations detected at IRP Site No. 1 and IRP Site No. 2 are compared, and the significance of detected contamination determined.

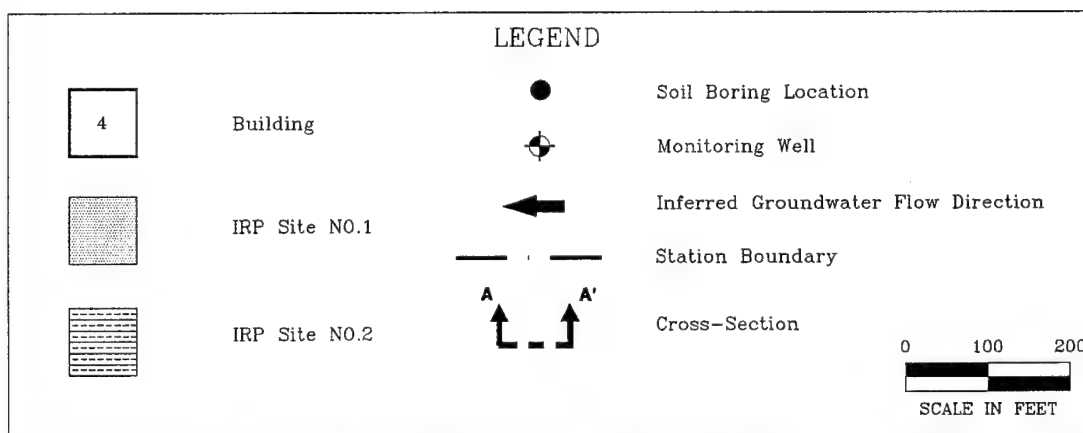
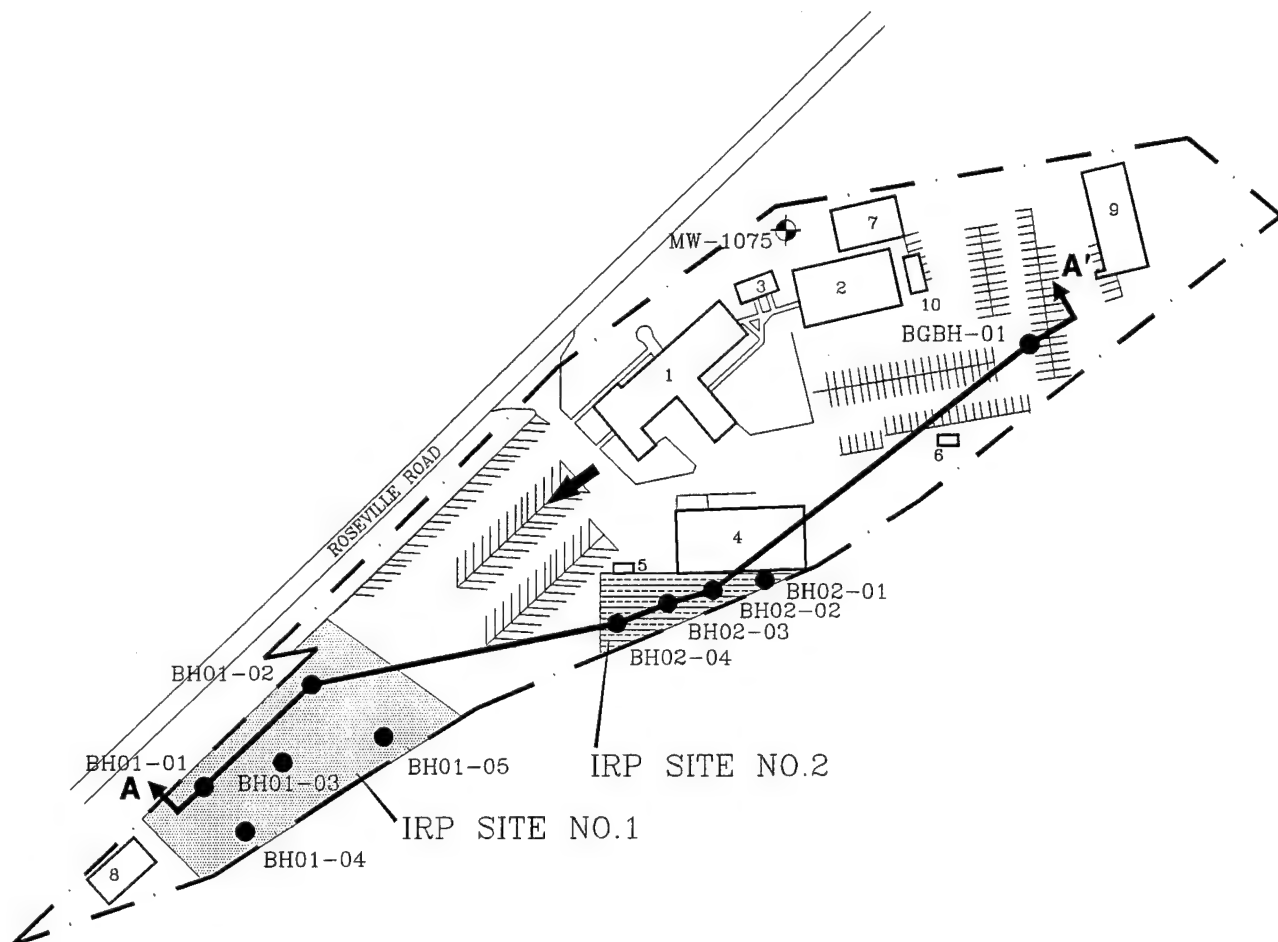
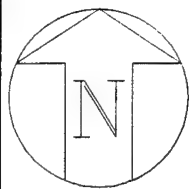


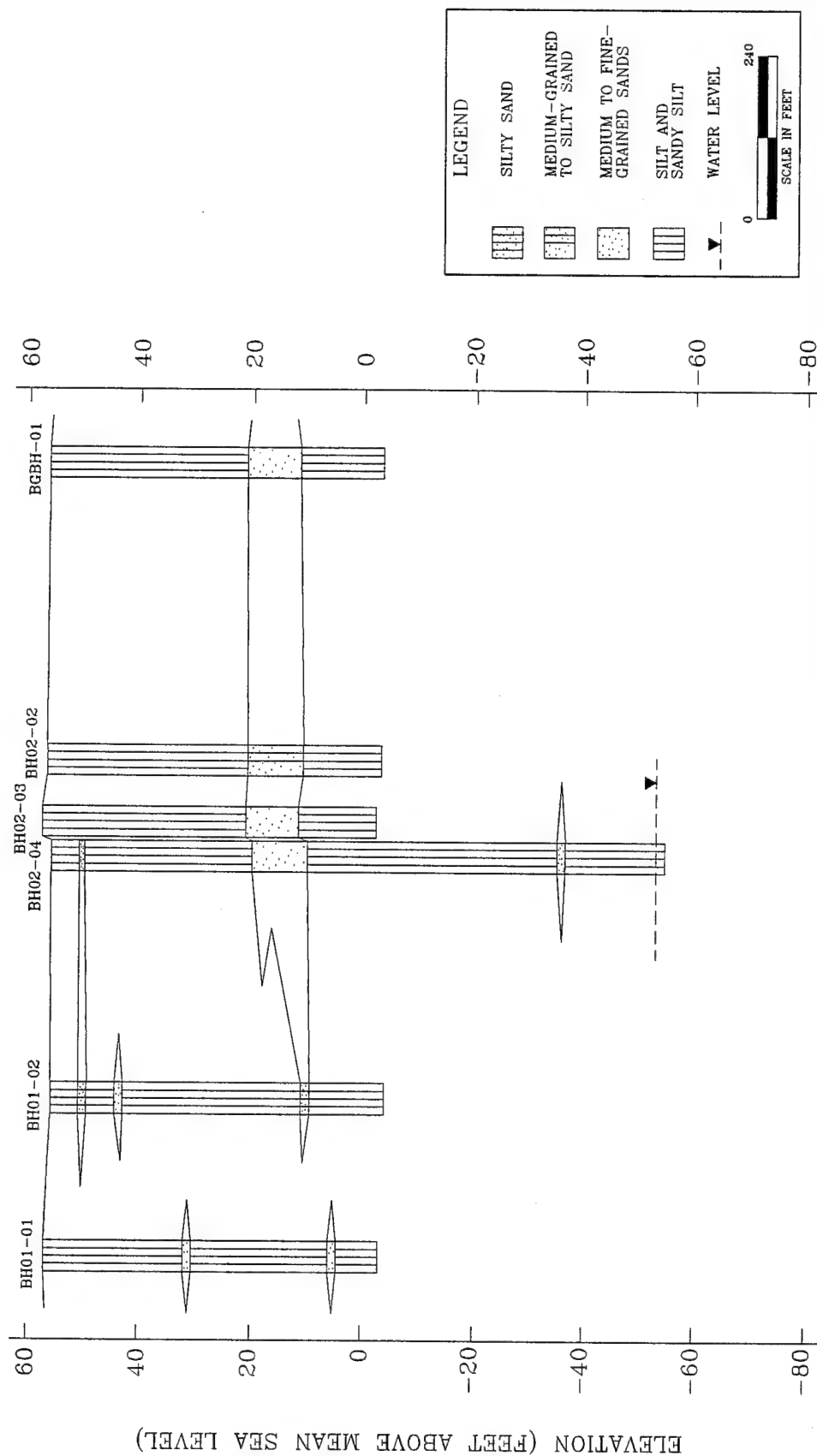
FIGURE 5.1

LOCATION OF
GEOLOGIC CROSS-SECTION A-A'
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

OPTTECH
OPERATIONAL TECHNOLOGIES
CORPORATION

SEPTEMBER 1995

SOUTHWEST A' NORTHWEST A'



GEOLOGIC CROSS-SECTION A-A'
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

FIGURE 5.2

NORTH/CROSS

OPTTECH
OPERATIONAL TECHNOLOGIES
CORPORATION

SEPTEMBER 1995

5.2.2 Screening Activities Results

5.2.2.1 Soil Vapor Sampling Results

Soil vapor samples were collected by TEG during the drilling of boring BGBH-01 on 20 June 1994. Six investigative soil vapor samples were collected. Soil vapor samples were obtained from depths of 11.0, 21.0, 31.0, 41.0, 51.0, and 61.0 feet BLS. Samples were analyzed for halogenated volatile hydrocarbons, BTEX, and TPH using USEPA methods SW8010, SW8020, and SW8015 Modified, respectively. Table 5.1 summarizes the maximum concentration detected and the detection limit for each analytical parameter. A complete listing of the soil vapor sampling results is given in Appendix A. Results obtained from the soil vapor sampling were used to select the soil samples for laboratory analysis.

Table 5.1
Maximum Concentrations Detected in Soil Vapor Samples
Collected from Background Boring BGBH-01
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Analytical Parameter	Maximum Concentration Detected (ppmv)	Detection Limit (ppmv)
1,1 Dichloroethene	0.63	0.01
Methylene Chloride	ND	0.01
trans-1,2 Dichloroethene	ND	0.01
1,1 Dichloroethane	ND	0.01
Chloroform	ND	0.01
1,1,1 Trichloroethane	ND	0.01
Carbon Tetrachloride	ND	0.01
1,2 Dichloroethane	ND	0.01
Trichloroethene	ND	0.01
1,2 Dichloropropane	ND	0.01
Bromodichloromethane	ND	0.01
cis-1,3 Dichloropropene	ND	0.01
trans-1,3 Dichloropropene	ND	0.01
1,1,2 Trichloroethane	ND	0.01
Tetrachloroethene	ND	0.01
Benzene	0.20	0.01
Toluene	0.09	0.01
Ethylbenzene	0.06	0.01
Total Xylenes	0.13	0.01
Total Petroleum Hydrocarbons	4.0	1.0

BGBH – Background Borehole.
ppmv – parts per million by volume.

ND – Not Detected.

1,1 Dichloroethene was detected at concentrations ranging from 0.09 to 0.63 parts per million by volume (ppmv) in four of the six samples analyzed; total xylenes from 0.03 to 0.13 ppmv in three of the samples; benzene, toluene, and TPH from 0.06 to 0.20 ppmv, 0.05 to 0.09 ppmv, and 2.0 to 4.0 ppmv, respectively, in two of the samples; and ethylbenzene was detected at a concentration of 0.06 ppmv in one of the six samples analyzed. The highest concentrations of 1,1-dichloroethene, benzene, and ethylbenzene were detected in the soil vapor sample collected from a depth of 31.0 feet BLS. The highest concentrations of toluene and total xylenes were detected in the samples collected from depths of 11.0 feet BLS and 21.0 feet BLS, respectively. The highest concentration of TPH was detected in the soil vapor sample collected from a depth of 61.0 feet BLS.

5.2.2.2 Field GC Screening Results of Soil Samples

Twelve soil samples were field screened with a Photovac 10S55 Portable GC, calibrated to screen for BTEX. Table 5.2 summarizes the maximum concentrations detected in soil samples collected from background boring BGBH-01. Complete GC data is included in Appendix C.

Table 5.2
Maximum GC Concentrations Detected in Soil Samples
Collected from Background Boring BGBH-01
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Compound	Maximum Concentrations Detected in Soil Samples (ppb)
Benzene	ND
Ethylbenzene	3
Toluene	5
Xylenes	ND

GC – Gas Chromatograph.
 BGBH – Background borehole.

ppb – parts per billion.
 ND – Not Detected.

Toluene was detected at concentrations ranging from 2 to 5 parts per billion (ppb) in five of the 12 soil samples analyzed. Ethylbenzene was detected at a concentration of 3 ppb in one of the 12 samples; benzene and xylenes were not detected in any of the soil samples analyzed.

The highest concentration of ethylbenzene was detected in the soil sample collected from a depth of 5.0 feet BLS. The highest concentration of toluene was detected in the soil sample collected from a depth of 35.5 feet BLS.

5.2.3 Soil Sampling Results

Background soil boring BGBH-01 was installed to a depth of 60.0 feet BLS and soil samples collected on 20 June 1994. Yellowish-brown sandy silt was encountered from surface to a depth of 35.5 feet BLS, reddish-gray arkosic granitic sand from 35.5 to 46.0 feet BLS, and yellowish-brown to reddish-gray sandy silt from 46.0 feet BLS to total depth. No saturated conditions were encountered.

Two investigative and one duplicate soil samples were collected for laboratory analysis. Sampling depths and the analytical program are indicated on Table 5.3.

The soil sample collected from a depth of 21.0 to 22.0 feet BLS was not analyzed for all priority pollutant metals designated under method SW6020. VOC and SVOC surrogate recoveries ranged from 88 to 105 percent and 71 to 98 percent, respectively, which are within acceptable limits. Quality assurance/quality control sample analytical results are reported in Appendix D.

Table 5.4 summarizes the analytes detected in soil samples collected from background soil boring BGBH-01. A complete listing of the results for all analytical parameters for each sample is given in Appendix E.

The VOC carbon disulfide was detected at a concentration of 8 micrograms per kilogram ($\mu\text{g/kg}$) in the duplicate soil sample collected from a depth of 58.0 feet BLS.

No SVOCs, TPH, or oil and grease were detected in the background soil samples.

Several of the priority pollutant metals analyzed for were detected in soil samples collected from the background sampling location (see Table 5.4). Copper, nickel, and zinc were detected at concentrations ranging from 8.2 to 11.0 milligrams per kilogram (mg/kg), 10.0 to 19.0 mg/kg , and 16.0 to 34.0 mg/kg , respectively, with the highest concentrations detected in the soil sample collected from a depth of 21.0 to 22.0 feet BLS. Chromium was detected at a concentration of 10.0 mg/kg , mercury at 0.050 mg/kg , and lead at concentrations of 3.4 mg/kg and 4.0 mg/kg in the soil samples collected from a depth of 58.0 feet BLS.

Table 5.3
Background Soil Sampling and Analytical Program
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Soil Boring Number	Sample Depth (Ft BLS)	Additional Samples	Soil Analyses and Methods				Oil & Grease (SM5520)
			VOCs (SW8240)	SVOCs (SW8270)	Metals (SW6020*)	TPH (SW8015 Mod)	
BGBH-01	21.0 - 22.0		x	x	x	x	x
BGBH-01	58.0		x	x	x	x	x
BGBH-01	58.0	Duplicate	x	x	x	x	x
		Equip. Blank	x	x	x	x	x
		Field Blank	x	x	x	x	x
		Trip Blank	x	N	N	N	N

BGBH - Background Borehole.

Ft BLS - Feet below land surface.

VOCs - Volatile Organic Compounds.

SVOCs - Semivolatile Organic Compounds.

TPH - Total Petroleum Hydrocarbons.

x - Indicates parameter was analyzed.

*With the exception of mercury (SW7471) and selenium (SW7742).

N - Indicates analysis was not run.

Table 5.4
Analytes Detected in Background Soil Samples
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Sample ID Number	Carbon disulfide (µg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Mercury (mg/kg)
BGBH-01-21-21.5'	5U	NAF	NAF	NAF	NAF	NAF	NAF
BGBH-01-21.5-22'	NAF	NAF	11.0	NAF	19.0	34.0	NAF
BGBH-01-58'	5U	10.0	8.2	4.0	12.0	16.0	0.010U
BGBH-01-58'-DUP	8	10.0	9.8	3.4	10.0	19.0	0.050

BGBH – Background Borehole.
µg/kg – Micrograms per kilogram.
mg/kg – Milligrams per kilogram.

NAF – Not analyzed for.

U – Compound was analyzed for but not detected. Number preceding the

"U" indicates the detection limit.

5.2.4 Groundwater Sampling Results

Table 5.5 gives results of groundwater sampling performed by McClellan AFB personnel. Sampling was done at MW-1075 which is located at North Highlands ANG. The location of MW-1075 is shown in Figure 5.1. All data was provided by the McClellan AFB Environmental Restoration Division.

5.3 IRP SITE NO. 1 (OLD AGE AREA) FINDINGS

IRP Site No. 1 is located on the southwest side of North Highlands ANG. The site is approximately 120 feet wide and approximately 320 feet long (see Figure 5.3). The site is covered with compacted, rocky soil having a sparse, vegetative cover. An antenna is located in the north central portion of the site. Asphalt borders the site to the northeast and a 6-foot high security fence bounds the site to the southeast, southwest, and northwest. Located outside the Station boundaries, an open storm drain parallels the fence line southeast of the site, and drainage ditches parallel the fence lines located to the southwest and northwest.

5.3.1 Geologic and Hydrologic Investigation Results

Soil samples collected from five soil borings were used to provide geologic information for describing the subsurface geology at IRP Site No. 1. Complete lithologic logs for the holes installed during this investigation are presented in Appendix B.

Yellowish-brown silt and sandy silt, with scattered lenses or seams of silty to medium-grained sands, were the predominant lithology encountered from surface to a depth of 60.0 feet BLS. However, a brown to reddish-gray, silty to fine-grained sand was encountered from a depth of 35.0 to 45.0 feet BLS in boring BH01-05. Saturated conditions were not encountered. Geologic cross-sections depicting the subsurface geology are indexed on Figure 5.4 and shown in Figures 5.5 and 5.6.

5.3.2 Screening Activities Results

5.3.2.1 Soil Vapor Sampling Results

Soil vapor samples were collected by TEG during the drilling of borings on 24, 27, and 28 June 1994. Twenty-eight investigative samples and one duplicate sample were collected. Soil vapor samples were obtained from depths of 11.0, 21.0, 31.0, 41.0, 51.0, and 61.0 feet BLS

Table 5.5
MW-1075 Groundwater Sampling Results
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Well	Method	Date Sampled	Date Analyzed	Analyte	Result (ppm)	Reporting Limit (ppm)	Action Level (ppm)
MW-1075	6010	04/18/94	04/29/94	Barium Calcium Magnesium Manganese Nickel Potassium Sodium Vanadium Zinc	0.044 21 14 0.0044 0.036 1.3 15 0.022 0.015	(0.0009) (0.0175) (0.0479) (0.0016) (0.0141) (0.822) (0.0401) (0.0045) (0.004)	1.0 MCL 0.10 MCL
MW-1075	7060	04/18/94	04/21/94	Arsenic	0.0019	(0.0006)	0.050 MCL
MW-1075	7421	04/18/94	04/21/94	Lead	ND	(0.0021)	0.015 MCL
MW-1075	7470	04/18/94	04/28/94	Mercury	ND	(0.0001)	0.0020 MCL
MW-1075	7740	04/18/94	04/22/94	Selenium	ND	(0.0018)	0.010 MCL
MW-1075	8010	04/18/94	04/25/94	No Analytes Detected	ND	N/A	N/A
MW-1075	8020	04/18/94	04/26/94	No Analytes Detected	ND	N/A	N/A
MW-1075	8010	08/03/94	08/11/94	No Analytes Detected	ND	N/A	N/A
MW-1075	8020	08/03/94	08/10/94	No Analytes Detected	ND	N/A	N/A

Table 5.5 (Continued)
MW-1075 Groundwater Sampling Results
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Well	Method	Date Sampled	Date Analyzed	Analyte	Result (ppm)	Reporting Limit (ppm)	Action Level (ppm)
MW-1075	6010	08/03/94	08/23/94	Barium	0.048	(0.0009)	1.0 MCL
				Beryllium	0.00060	(0.0005)	0.0040 MCL
				Calcium	20	(0.0175)	
				Chromium	0.011	(0.0052)	0.050 MCL
				Copper	0.013	(0.0092)	1.3 MCL
				Magnesium	15	(0.0479)	
				Manganese	0.020	(0.0016)	
				Nickel	0.15	(0.0141)	0.10 MCL
				Potassium	1.4	(0.822)	
				Sodium	15	(0.0401)	
MW-1075	7060	08/03/94	08/16/94	Vanadium	0.021	(0.0045)	
				Arsenic	0.0024	(0.0006)	0.050 MCL
				Lead	ND	(0.0021)	0.015 MCL
				Mercury	ND	(0.000033)	0.0020 MCL
MW-1075	6010	10/24/94	10/31/94	Selenium	ND	(0.0018)	0.010 MCL
				Arsenic	ND	(0.0468)	0.050 MCL
				Barium	0.045	(0.0009)	1.0 MCL
				Calcium	20	(0.0175)	
				Iron	0.060	(0.0045)	0.015 MCL
				Lead	ND	(0.0216)	
				Magnesium	14	(0.0479)	
				Manganese	0.052	(0.0016)	0.10 MCL
				Nickel	0.28	(0.0141)	
				Potassium	1.3	(0.822)	0.010 MCL
				Selenium	ND	(0.0891)	
				Sodium	14	(0.0401)	
				Vanadium	0.020	(0.0045)	
				Arsenic	0.0022	(0.0006)	0.050 MCL
MW-1075	7421	10/24/94	10/30/94	Lead	ND	(0.001)	0.015 MCL
				Mercury	ND	(0)	0.0020 MCL

Table 5.5 (Concluded)
MW-1075 Groundwater Sampling Results
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Well	Method	Date Sampled	Date Analyzed	Analyte	Result (ppm)	Reporting Limit (ppm)	Action Level (ppm)
MW-1075	7740	10/24/94	10/27/94	Selenium	ND	(0.0006)	0.010 MCL
MW-1075	8010	10/24/94	11/02/94	No Analytes Detected	ND	N/A	N/A
MW-1075	8020	10/24/94	10/31/94	No Analytes Detected	ND	N/A	N/A

Source: McClellan AFB Environmental Restoration Division.

MW - Monitoring well.

ND - Not detected.

MCL - Maximum contaminant level.
ppm - Parts per million.

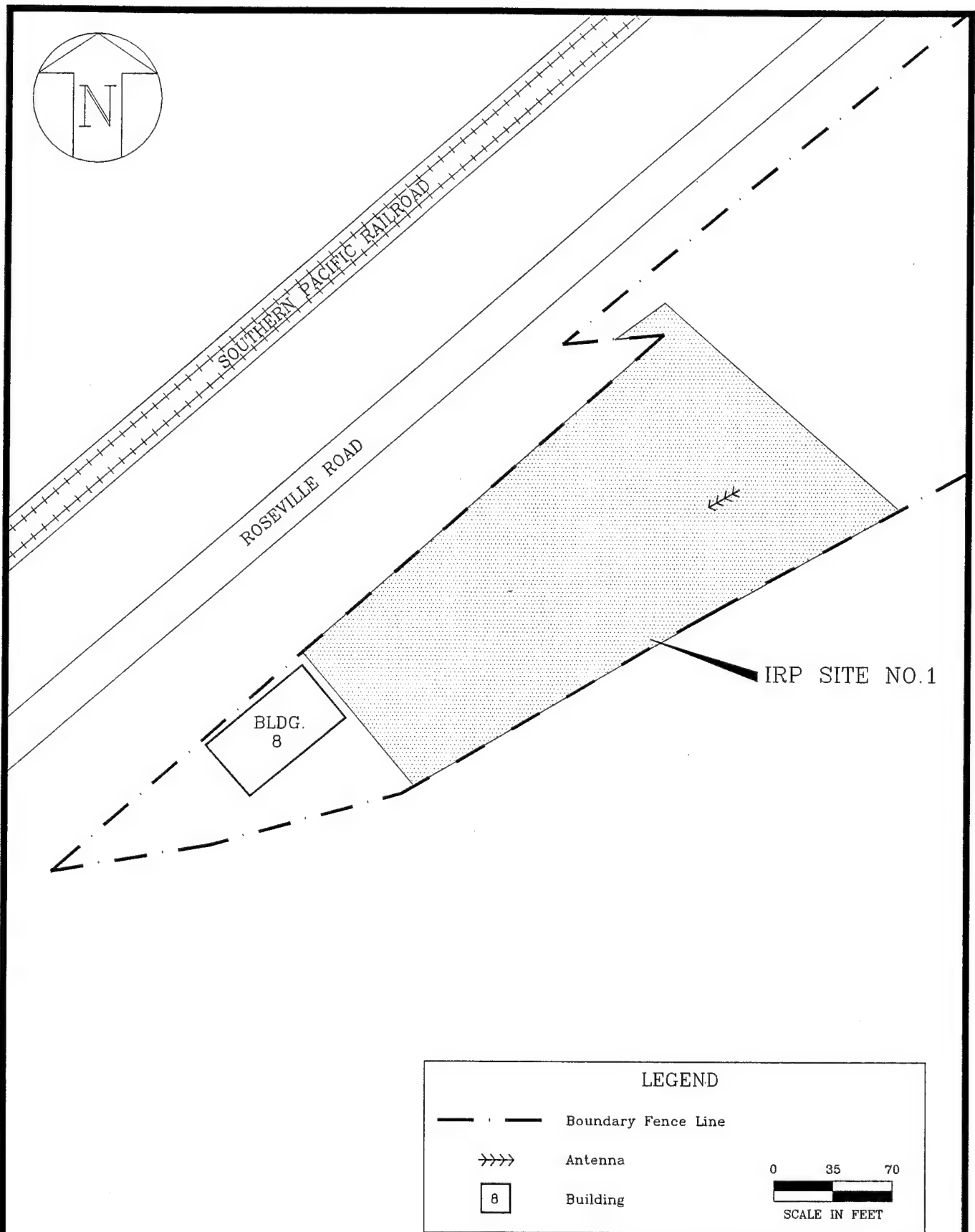


FIGURE 5.3

IRP SITE NO.1 SITE PLAN
 162nd CCGP & 149th CCSQ
 North Highlands ANG
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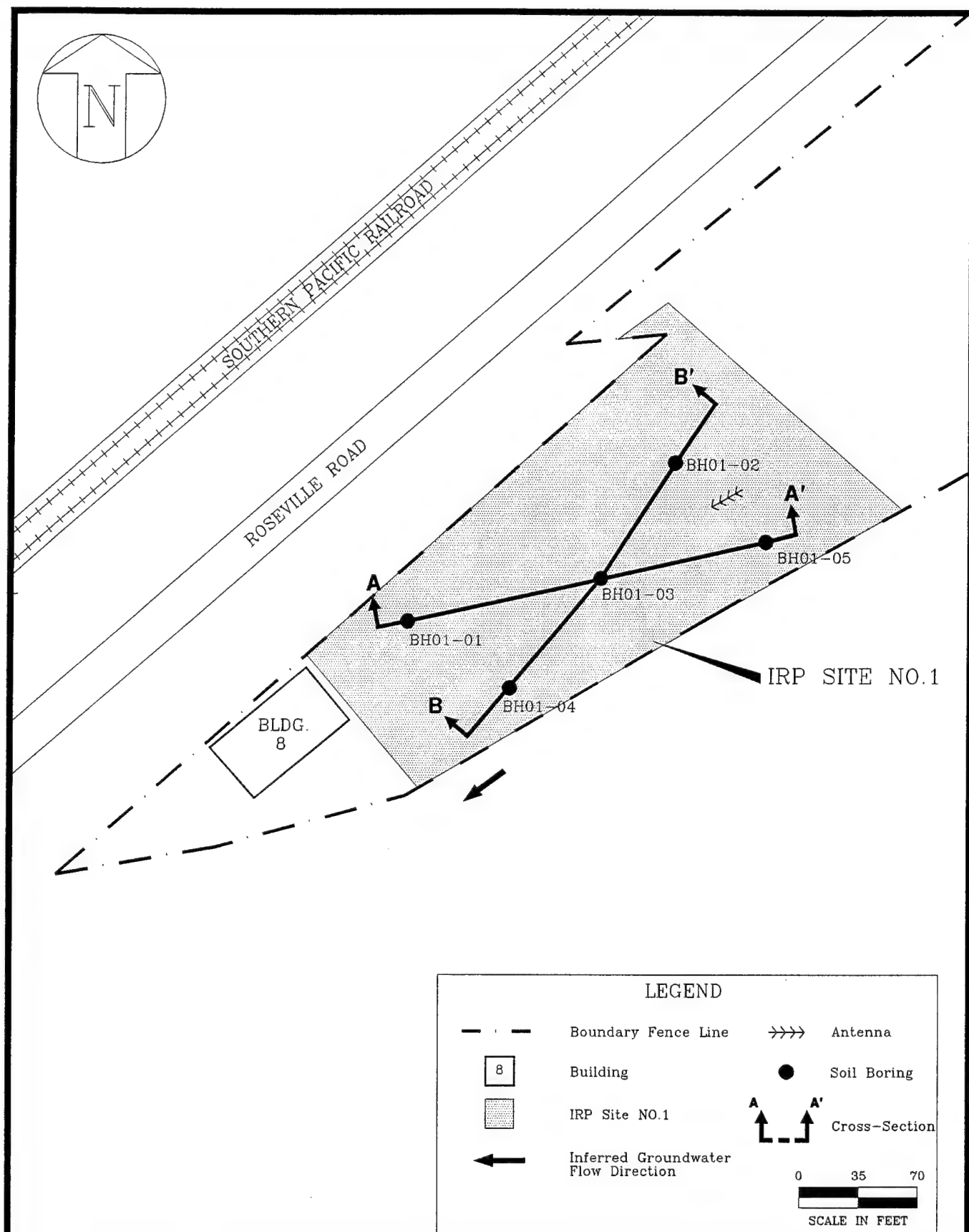
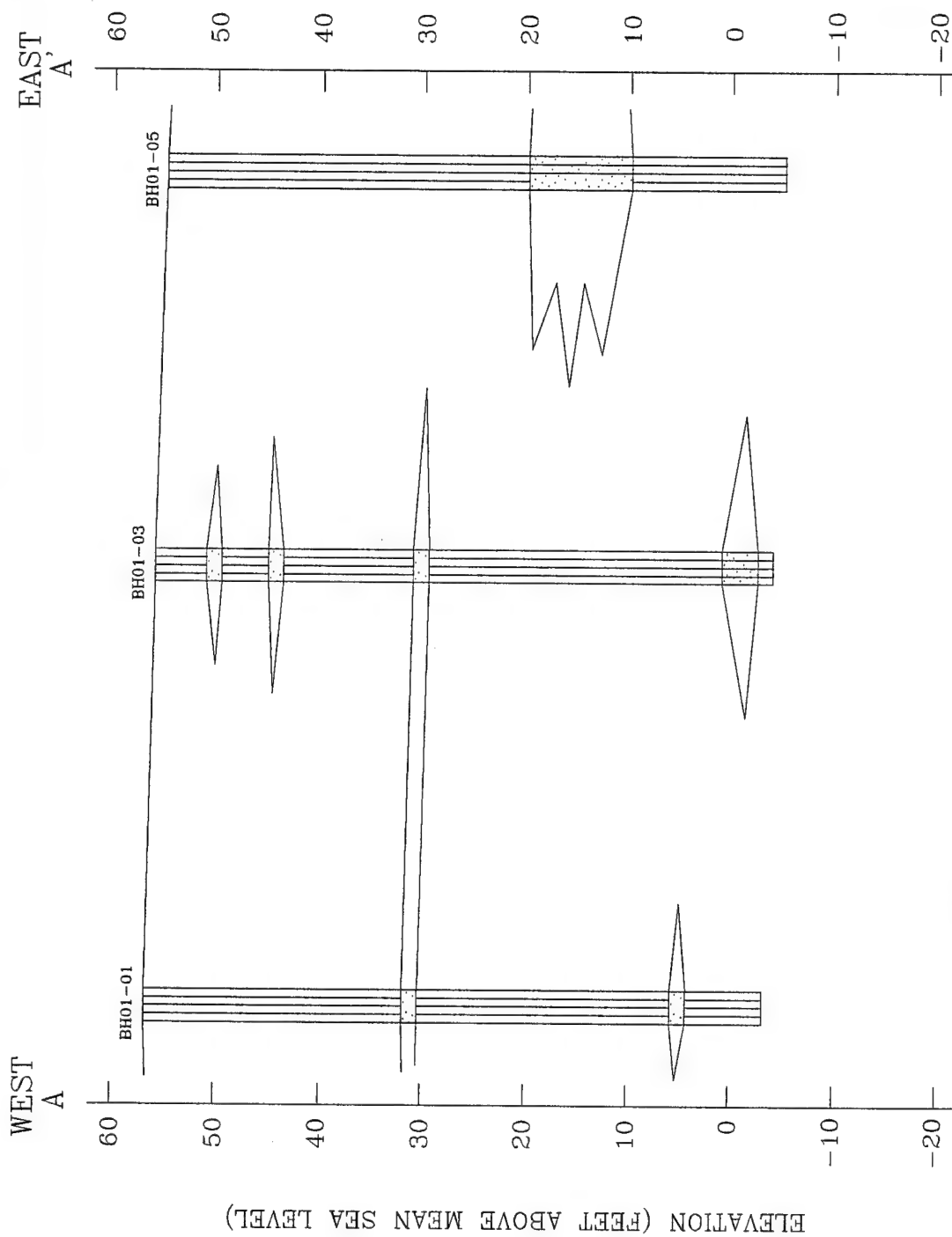


FIGURE 5.4

LOCATIONS OF GEOLOGIC CROSS-
SECTIONS A-A' AND B-B'
AT IRP SITE NO.1
162nd CCGP & 149th CCSQ
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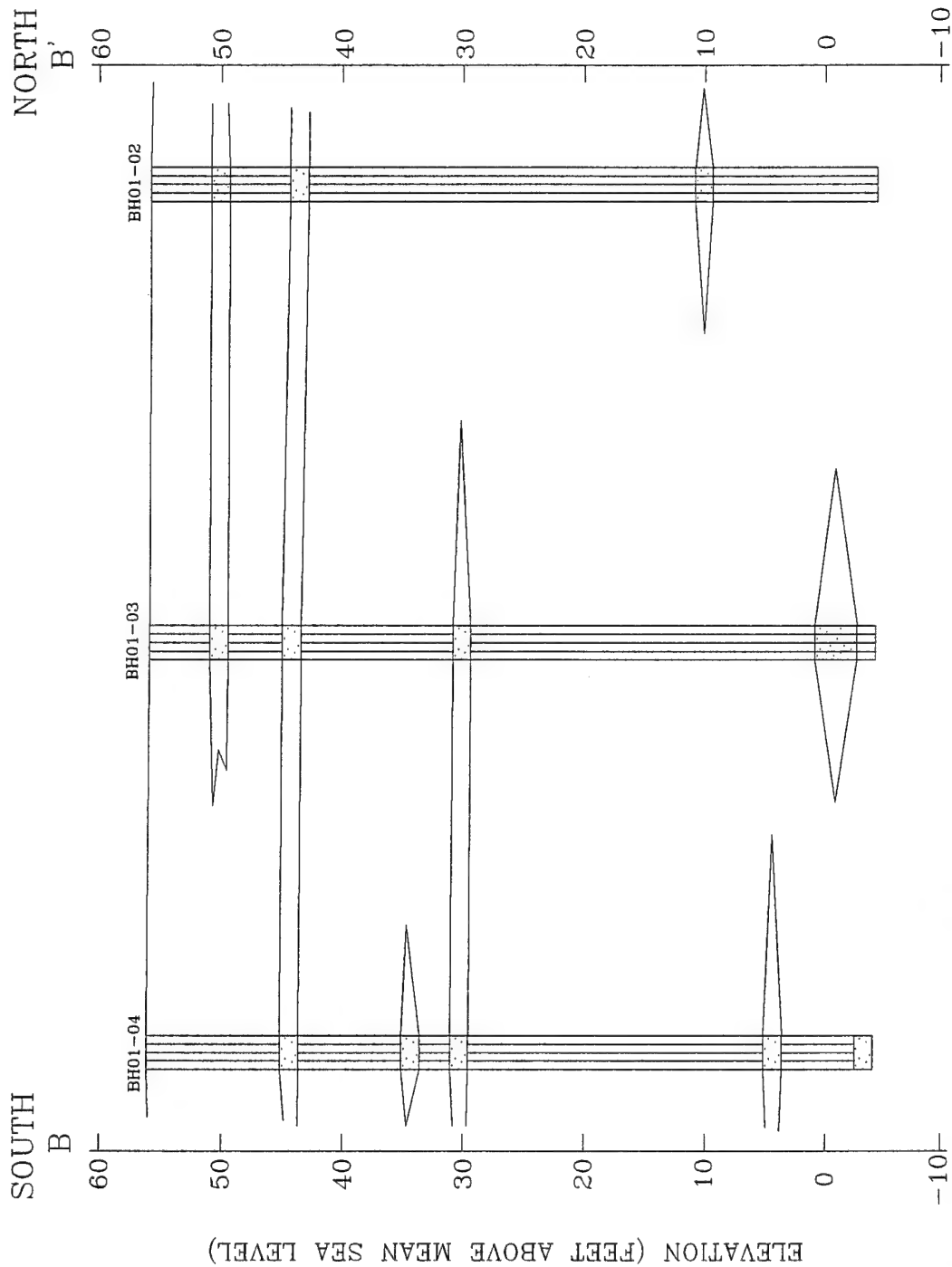
GEOLOGIC CROSS-SECTION A-A' AT IRP SITE NO.1
 162nd CCGP & 149th CCSQ
 North Highlands ANG
 Sacramento, California

FIGURE 5.5

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GEOLOGIC CROSS-SECTION B-B' AT IRP SITE NO.1

162nd CCGP & 149th CCSq
North Highlands ANG
Sacramento, California

FIGURE 5.6

NORTH\CROSS4

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from each soil boring, with the following exceptions: Soil vapor samples were not collected from a depth of 61.0 feet BLS in boring BH01-01 nor from a depth of 51.0 feet BLS in boring BH01-04 because of soil conditions; and a soil vapor sample was collected from a depth of 46.0 feet BLS, rather than 41.0 feet BLS, from boring BH01-05. Samples were analyzed for halogenated volatile hydrocarbons, BTEX, and TPH using USEPA methods SW8010, SW8020, and SW8015 Modified, respectively. Table 5.6 summarizes the maximum concentration and detection limit for each analytical parameter. A complete listing of the soil vapor sampling results is given in Appendix A. Results obtained from the soil vapor sampling were used to select the soil samples for laboratory analysis from IRP Site No. 1.

Table 5.6
Maximum Concentrations Detected in Soil Vapor Samples
Collected from IRP Site No. 1
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Analytical Parameter	Maximum Concentration Detected (ppmv)	Detection Limit (ppmv)
1,1 Dichloroethene	ND	0.01
Methylene Chloride	0.11	0.01
trans-1,2 Dichloroethene	ND	0.01
1,1 Dichloroethane	ND	0.01
Chloroform	ND	0.01
1,1,1 Trichloroethane	ND	0.01
Carbon Tetrachloride	ND	0.01
1,2 Dichloroethane	ND	0.01
Trichloroethene	ND	0.01
1,2 Dichloropropane	ND	0.01
Bromodichloromethane	ND	0.01
cis-1,3 Dichloropropene	ND	0.01
trans-1,3 Dichloropropene	ND	0.01
1,1,2 Trichloroethane	ND	0.01
Tetrachloroethene	ND	0.01
Benzene	0.19	0.01
Toluene	0.13	0.01
Ethylbenzene	0.16	0.01
Total Xylenes	0.15	0.01
Total Petroleum Hydrocarbons	3.0	1.0

ppmv – parts per million by volume.
ND – Not Detected.

Toluene, total xylenes, and TPH were detected at concentrations ranging from 0.03 to 0.13 ppmv, 0.04 to 0.15 ppmv, and at a concentration of 3.0 ppmv, respectively, in four of the 29 samples analyzed; benzene from 0.06 to 0.19 ppmv in three of the samples; and ethylbenzene from 0.06 to 0.16 ppmv in two of the samples analyzed. Methylene chloride was detected at

a concentration of 0.11 ppmv in one of the 29 samples analyzed. The highest concentrations of detected parameters, with the exception of TPH, were in soil vapor samples collected from soil boring BH01-03, located in the center of the site. The highest concentrations of benzene and toluene were detected in the soil vapor sample collected from a depth of 11.0 feet BLS. Methylene chloride and the highest concentrations of ethylbenzene and total xylenes were detected in the sample collected from a depth of 21.0 feet BLS. TPH was detected at a concentration of 3 ppmv in soil vapor samples collected from borings BH01-01 from depths of 41.0 feet BLS and 51.0 feet BLS, BH01-04 from a depth of 11.0 feet BLS, and BH01-05 from a depth of 46.0 feet BLS.

5.3.2.2 Field GC Screening Results of Soil Samples

Sixty-one soil samples were field screened with a Photovac 10S55 Portable GC, calibrated to screen for BTEX. Table 5.7 summarizes the maximum concentrations detected in soil samples collected from IRP Site No. 1. Complete GC data is included in Appendix C.

Table 5.7
Maximum GC Concentrations Detected in Soil Samples
Collected from IRP Site No. 1
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Compound	Maximum Concentrations Detected in Soil Samples (ppb)
Benzene	26
Toluene	103
Ethylbenzene	694
Xylenes	170

GC – Gas Chromatograph.
ppb – parts per billion.

Toluene and xylenes were detected at concentrations ranging from 5 to 103 ppb and 6 to 170 ppb, respectively, in six of the samples analyzed; benzene from 7 to 26 ppb in five of the samples; and ethylbenzene from 11 to 694 ppb in four of the samples.

All parameters, with the exception of toluene, were detected only in soil samples collected from boring BH01-02, located in the northwest portion of the site. The highest concentrations of toluene, ethylbenzene, and xylenes were detected in the soil sample collected from a depth of 45.5 feet BLS. The highest concentration of benzene was detected in the sample collected from

a depth of 35.5 feet BLS. Toluene was also detected at a concentration of 35 ppb in the soil sample collected from boring BH01-05 from a depth of 45.5 feet BLS.

5.3.3 Soil Investigation Findings

Soil samples collected from five soil borings were used to provide geologic information for describing the subsurface geology at IRP Site No. 1. Eleven investigative soil samples were submitted for laboratory analysis to provide an assessment of the presence and type of soil contamination present.

5.3.3.1 Soil Boring Locations

Five soil borings were installed at the site to obtain soil samples for laboratory analysis for defining any existing soil contamination, and to aid in defining the vertical and horizontal extent of contamination. Soil samples were also used for characterizing site geology and subsurface soil conditions. All soil borings were drilled in the locations originally proposed in the Work Plan. The rationale for placement of soil borings considered the lack of information on specific locations of such spills and/or disposal of the wastes. Therefore, boring locations were placed in a pattern to maximize the areal coverage of confirmatory sampling. The soil boring locations are indicated on Figure 5.7.

5.3.3.2 Nature and Extent of Soil Contamination

Five soil borings were installed at IRP Site No. 1 from which 11 investigative and one duplicate soil samples were collected for laboratory analysis. The borings were installed to a depth of 60.0 feet BLS and soil samples collected on 24, 27, and 28 June 1994.

VOC surrogate recoveries ranged from 94 to 106 percent, which is within acceptable limits. SVOC surrogate recoveries ranged from 19 to 131 percent, which is within acceptable limits, except for samples BH01-02-12', BH01-03-12', BH01-03-58'-dup, and BH01-05-59', which are outside of quality control limits. VOC and SVOC matrix spike recoveries ranged from 78 to 102 percent and 52 to 130 percent, respectively, which are within acceptable ranges. Quality assurance/quality control sample analytical results are reported in Appendix D. A complete listing of the results for all analytical parameters for each sample is given in Appendix E.

No VOCs, SVOCs, TPH, or oil and grease were detected in soil samples collected from IRP Site No. 1.

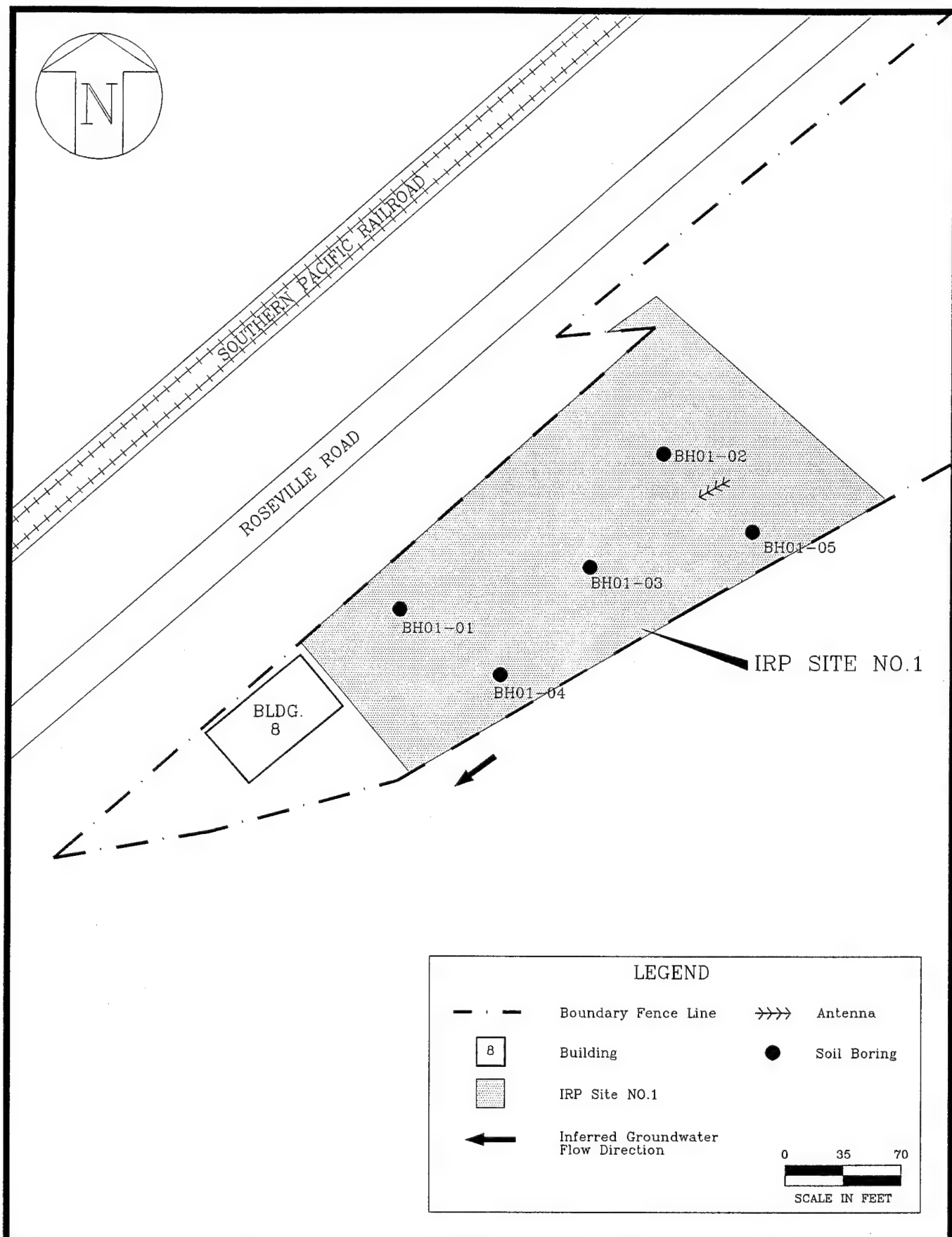


FIGURE 5.7

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SOIL BORING LOCATIONS
AT IRP SITE NO.1
162nd CCGP & 149th CCSQ
North Highlands ANG
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5.3.3.2.1 Metals Contamination

Soil samples were analyzed for priority pollutant metals using method SW6020, with the exception of samples collected from borings BH01-02, BH01-03, and BH01-05, which were analyzed using method SW6010. Samples were analyzed by method SW6010 when laboratory equipment used for method SW6020 malfunctioned and repairs could not be made in a timely fashion. Consequently, soil samples analyzed by method SW6010 reflect higher reporting limits due to limitations of that method.

Metals detected in soil samples collected from IRP Site No. 1 are shown in Table 5.8. The highest concentrations of all detected metals, with the exception of nickel, mercury, and silver, were detected in the soil sample collected from boring BH01-02 from a depth of 59.0 feet BLS. Boring BH01-02 is located in the northwest portion of the site.

Arsenic was detected at concentrations ranging from 0.81 to 73.0 mg/kg in four of the 12 soil samples analyzed, and cadmium from 5.0 to 61.0 mg/kg in two of the samples, with the highest concentrations of each detected in soil sampled from boring BH01-02 from a depth of 59.0 feet BLS. Silver was detected in one of the 12 samples analyzed at a concentration of 11.0 mg/kg in the soil sample collected from boring BH01-03 from a depth of 58.0 feet BLS. Thallium was detected in three of the 12 samples analyzed. Thallium was detected at a concentration of 34.0 mg/kg in the soil sample collected from boring BH01-03 from a depth of 58.0 feet BLS, and a concentration of 36.0 mg/kg in samples collected from borings BH01-02 and BH01-05 from a depth of 59.0 feet BLS. Arsenic, cadmium, silver, and thallium were not detected in the background samples.

Chromium was detected at concentrations ranging from 4.0 to 90.0 mg/kg, with concentrations exceeding background in 10 of the 12 samples analyzed, with the exceptions being the soil samples collected from borings BH01-02 and BH01-04 from a depth of 12.0 feet BLS. Copper was detected at concentrations ranging from 3.5 to 76.0 mg/kg, with concentrations exceeding background in eight of the 12 samples analyzed, with the exceptions being samples collected from borings BH01-01 and BH01-02 from a depth of 12.0 feet BLS and soil sampled from boring BH01-04. Lead was detected at concentrations exceeding background in soil samples collected from boring BH01-02 from a depth of 59.0 feet BLS and boring BH01-03 from depths of 22.0 feet BLS and 58.0 feet BLS. Zinc was detected at concentrations ranging from 5.9 to 95.0 mg/kg with concentrations exceeding background in six of the 12 samples analyzed. Zinc was detected at concentrations exceeding background in soil samples collected from borings BH01-02 and BH01-05 from depths of 59.0 feet BLS and 42.0 feet BLS, respectively, and in

Table 5.8
Metals Detected in Soil Samples
Collected from IRP Site No. 1
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Sample ID Number	Arsenic mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Lead mg/kg	Silver mg/kg	Thallium mg/kg	Zinc mg/kg	Mercury mg/kg	Nickel mg/kg
BH01-01-12'	0.500U	0.500U	12.0	7.6	3.4	0.500U	0.500U	14.0	0.031	6.0
BH01-01-59'	0.500U	0.500U	15.0	13.0	3.2	0.500U	0.500U	24.0	0.040	21.0
BH01-02-12'	30.0U	5.0U	5.0U	5.5	5.0U	5.0U	30.0U	9.2	0.20U	50.0U
BH01-02-59'	73.0	61.0	90.0	76.0	68.0	5.0U	36.0	95.0	0.20U	50.0U
BH01-03-12'	55.0	5.0U	45.0	19.0	5.0U	5.0U	5.0U	52.0	0.018	50.0U
BH01-03-22'	30.0U	5.0	11.0	28.0	9.2	5.0U	30.0U	41.0	0.010U	50.0U
BH01-03-58'	31.0	5.0U	40.0	30.0	5.0U	11.0	34.0	62.0	0.20U	50.0U
BH01-03-58'-DUP	30.0U	5.0U	35.0	26.0	5.0	5.0U	30.0U	54.0	0.20U	50.0U
BH01-04-12'	0.500U	0.500U	4.0	3.5	1.8	0.500U	0.500U	5.9	0.027	3.0
BH01-04-59'	0.81	0.500U	12.0	11.0	2.9	0.500U	0.500U	20.0	0.038	18.0
BH01-05-42'	30.0U	5.0U	13.0	15.0	5.0U	5.0U	30.0U	37.0	0.20U	50.0U
BH01-05-59'	30.0U	5.0U	20.0	15.0	5.0U	5.0U	36.0	27.0	0.20U	50.0U
Maximum Background Concentrations	0.500U	0.500U	10.0	11.0	4.0	0.500U	0.500U	34.0	0.050	19.0
Total Designated Levels	500.0 ^b	100.0 ^b	500.0 ^b	10,000.0 ^c	500.0 ^b	500.0 ^b	10.0 ^a	50,000.0 ^c	20.0 ^b	1,000.0 ^a

mg/kg - milligrams per kilogram.

BH - Borehole.

U - Compound was analyzed for but not detected. Number preceding "U" indicates the detection limit.

^aUSEPA Primary Maximum Contaminant Level (MCL) used as the water quality goal.

^bCalifornia Dept. of Health Services Primary MCL used as the water quality goal.

^cCalifornia Dept. of Health Services Secondary MCL used as the water quality goal.

all soil sampled from boring BH01-03. Nickel was detected at concentrations ranging from 3.0 to 21.0 mg/kg, with the only sample to exceed background collected from boring BH01-01 from a depth of 59.0 feet BLS.

A Total Designated Level (TDL) was calculated for each metal using the Designated Level Methodology. TDLs were calculated by multiplying water quality goals (expressed in milligrams per liter (mg/L)) by a generic environmental attenuation factor (100) and the generic leachability factor for inorganics (100). The most limiting available and applicable water quality goal for each metal was utilized. An attenuation factor of 100 was applied because 45.0 feet of fine silts lie between the lowest sampling depth and groundwater. TDLs are indicated in Table 5.8 and were derived for use as cleanup levels for metals. All of the above metals were detected at concentrations well below their respective TDL, with the exception of thallium (see Table 5.8).

5.3.4 Conclusions

Soil vapor samples and soil samples were collected from IRP Site No. 1 and submitted for laboratory analysis to confirm the presence or absence of contamination and to provide data needed to reach a decision point for the site. Past activities at the site indicated that suspected contamination consists primarily of waste oils, solvents, fuels, paint, and thinners. Therefore, soil vapor samples were submitted for analysis of halogenated volatile hydrocarbons, BTEX, and TPH. Soil samples were submitted for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease.

Soil vapor samples were collected during the drilling of soil borings. The highest concentrations of detected parameters were in soil vapor samples collected from soil boring BH01-03, located in the center of the site. Benzene and toluene were detected at maximum concentrations of 0.19 ppmv and 0.13 ppmv, respectively, in the soil vapor sample collected from a depth of 11.0 feet BLS. Methylene chloride, ethylbenzene and total xylenes were detected at maximum concentrations of 0.11 ppmv, 0.16 ppmv, and 0.15 ppmv, respectively, in the soil vapor sample collected from a depth of 21.0 feet BLS. TPH was detected at a maximum concentration of 3.0 ppmv in soil vapor samples collected from IRP Site No. 1. Parameters detected in the soil vapor sampling were not confirmed in the soil samples collected and submitted for laboratory analysis from IRP Site No. 1.

Only those parameters detected in soil samples, reported at greater than the method reporting limit, exceeding TDLs, derived for use as cleanup levels, are addressed in this section.

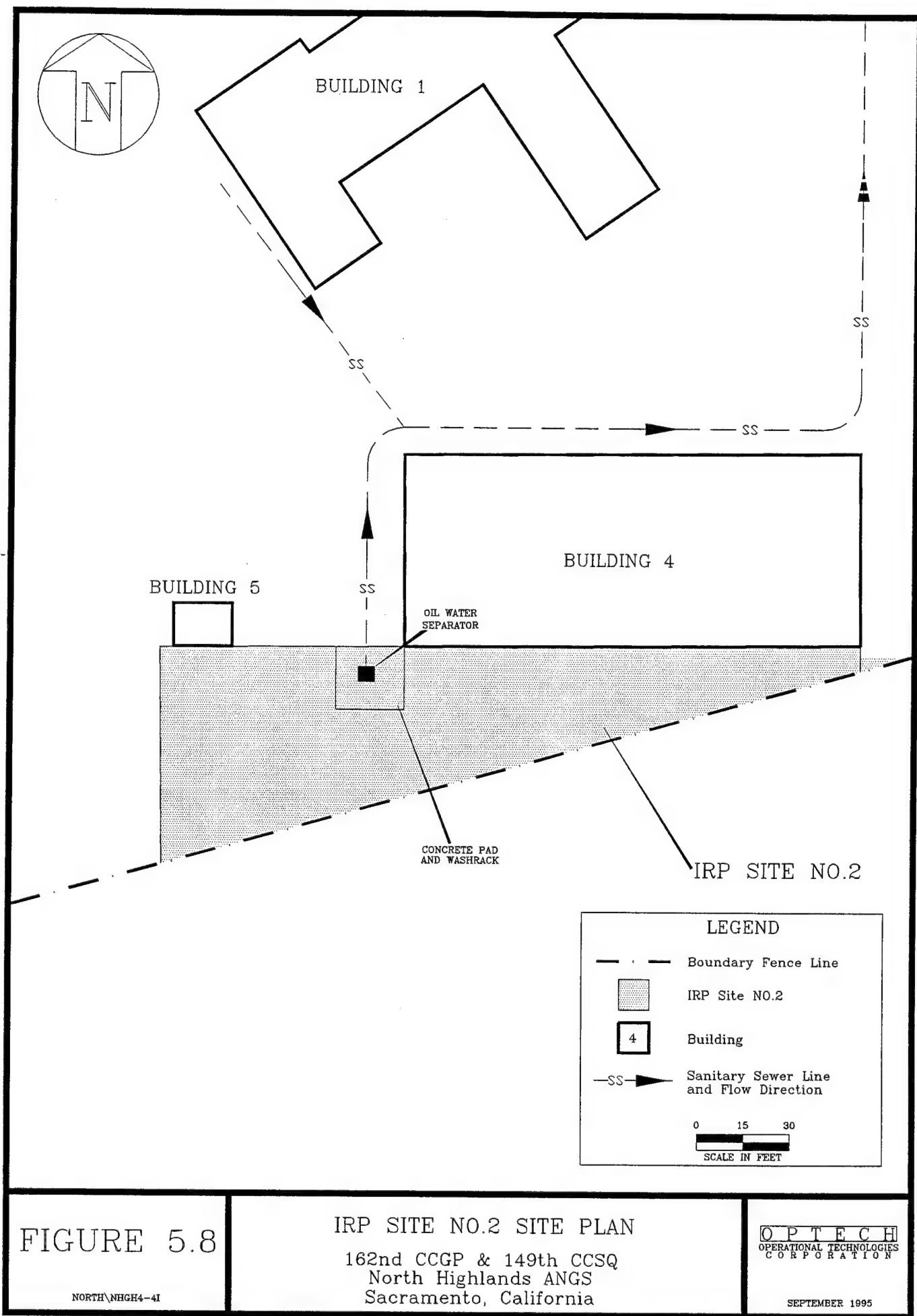
Thallium was detected at concentrations exceeding its TDL. Thallium was detected at a concentration of 34.0 mg/kg in the soil sample collected from boring BH01-03 from a depth of 58.0 feet BLS and a concentration of 36.0 mg/kg in samples collected from borings BH01-02 and BH01-05 from a depth of 59.0 feet BLS.

5.4 IRP SITE NO. 2 (AREA BEHIND VEHICLE MAINTENANCE) FINDINGS

IRP Site No. 2 is located on the east side of North Highlands ANG. The site is located immediately behind (south) Building 4, the Vehicle Maintenance Shop, and extends to the west approximately 85 feet, and then extends south to the boundary fence line (see Figure 5.8). The site is covered with asphalt and is used for storage of vehicles and grounds/vehicle maintenance equipment. Waste oil, antifreeze, and fuel/transmission filters are also stored at the site in 55-gallon drums. A washrack and oil/water separator are located behind the southwest corner of Building 4. Drainage from the washrack is drawn into the oil/water separator which is connected to the sanitary sewer. Located outside the Station boundaries, an open storm drain parallels the fence line south of the site.

5.4.1 Geologic and Hydrologic Investigation Results

IRP Site No. 2 was investigated because of the potential for contamination related to the disposal of waste solvents, paints and thinners along a boundary fence line from the late 1950s through the mid-1960s. The site is located immediately behind the vehicle maintenance shop, and extends south to the current boundary fence line, which is located approximately 5 to 30 feet south of the former fence line. A former surface depression was located within the areal extent of the site, and this depression received surface water runoff from the area behind the vehicle maintenance shop. As proposed in the Work Plan, one boring, BH02-04, was placed in the area of the former surface depression, and the remaining three borings (BH02-03, BH02-02, and BH02-01) were placed along the area of the former fence line and south of the oil/water separator (OWS). During the SI fieldwork, borings were placed in accordance with the Work Plan, with one adjustment: Boring BH02-03 was moved to the west (and downgradient) of the boring location proposed in the Work Plan, because the OWS was found to be located in the concrete pad at the site, instead of at the southwest corner of Building 4.



Soil samples collected from four soil borings were used to provide geologic information for describing the subsurface geology at IRP Site No. 2. Complete lithologic logs for the holes installed during this investigation are presented in Appendix B.

A bailer was used to collect a groundwater sample, designated as BH02-04-GW-105; from boring BH02-04 from the water table. However, the high silt content of the sample (90% visually in the bottles) precluded it from being analyzed as a water sample. Filtering was not considered a feasible option by the contract laboratory and the sample was subsequently analyzed as a solid.

Yellowish-brown to reddish-gray silt and sandy silt were generally encountered from surface to a depth of 36.0 feet BLS, reddish-gray to olive brown silty to medium-grained sand from 36.0 to 46.0 feet BLS, and reddish-gray to olive brown silt and sandy silt to a depth of 110.0 feet BLS. Saturated conditions were encountered at a depth of 109.0 feet BLS. Geologic cross-section A-A', depicting the subsurface geology, is indexed on Figure 5.9 and shown in Figure 5.10.

5.4.2 Screening Activities Results

5.4.2.1 Soil Vapor Sampling Results

Soil vapor samples were collected by TEG during the drilling of borings on 21, 22, and 23 June 1994. Twenty-eight investigative samples and two duplicate samples were collected. Soil vapor samples were obtained from depths of 11.0, 21.0, 31.0, 41.0, 51.0, and 61.0 feet BLS from each soil boring. Additional soil vapor samples were collected from depths of 71.0, 86.0, 91.0, and 101.0 feet BLS from boring BH02-04. Samples were analyzed for halogenated volatile hydrocarbons, BTEX, and TPH using USEPA methods SW8010, SW8020, and SW8015 Modified, respectively. Table 5.9 summarizes the maximum concentration detected and the detection limit for each analytical parameter. A complete listing of the soil vapor sampling results is given in Appendix A. Results obtained from the soil vapor sampling were used to select the soil samples for laboratory analysis from IRP Site No. 2.

Chloroform was detected at concentrations ranging from 0.01 to 0.39 ppmv in 13 of the 30 samples analyzed; carbon tetrachloride and TPH from 0.01 to 0.31 ppmv and 2.0 to 7.0 ppmv, respectively, in 12 of the samples; 1,1-dichloroethene and toluene from 0.01 to 0.04 ppmv and 0.03 to 0.30 ppmv, respectively, in three of the samples; benzene and total xylenes at 0.05 ppmv

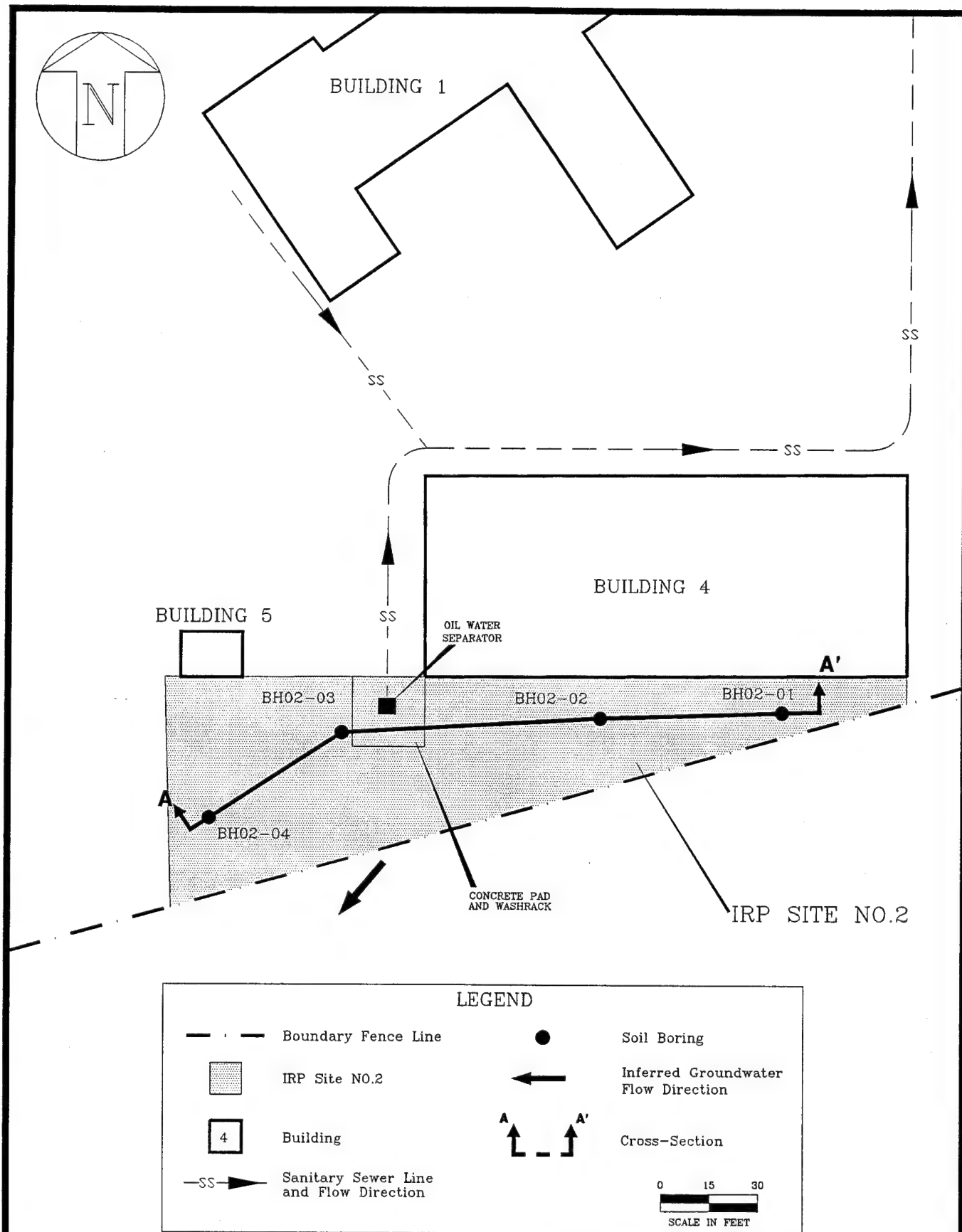


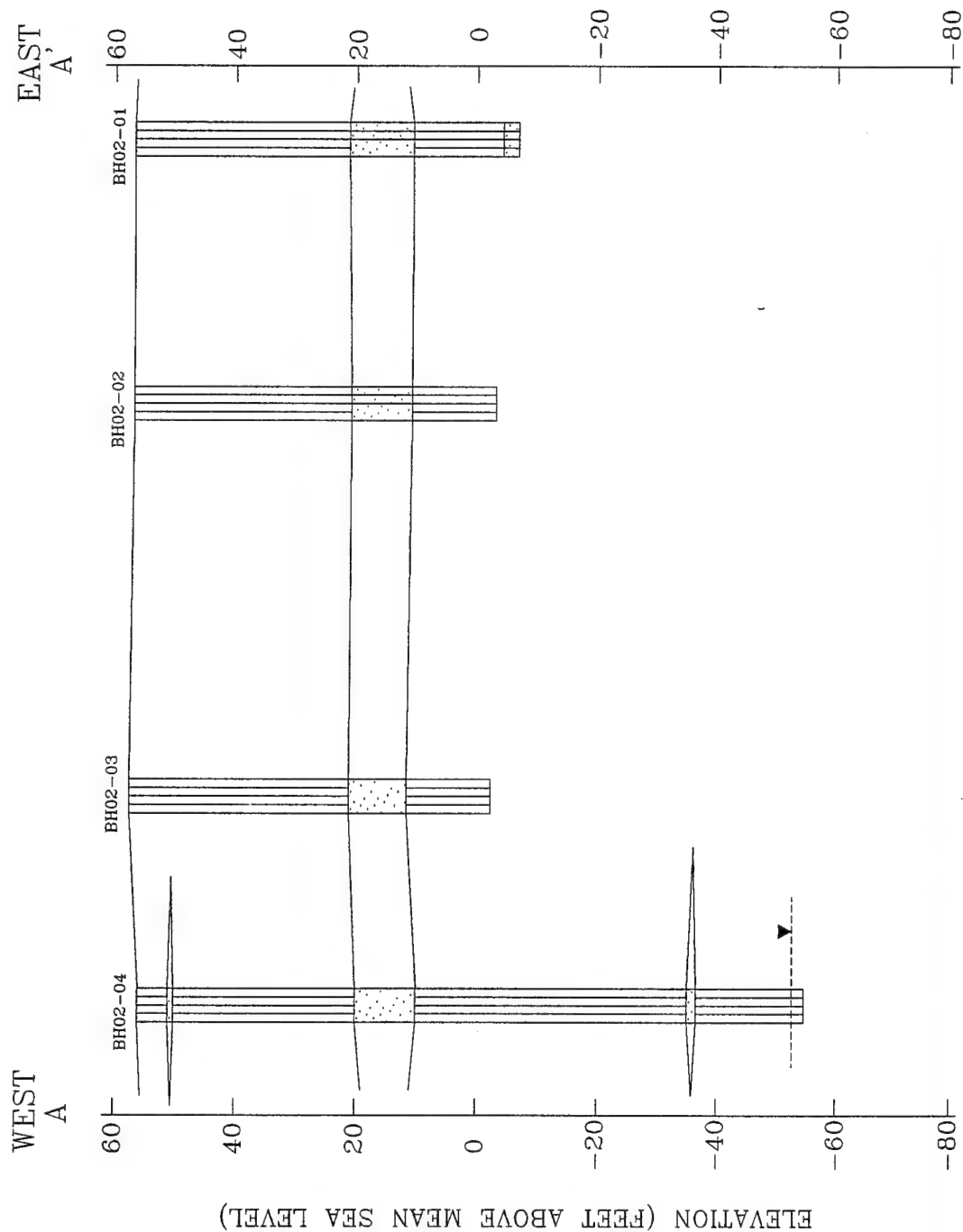
FIGURE 5.9

NORTH\NO2-AA

LOCATION OF GEOLOGIC
CROSS-SECTION A-A'
AT IRP SITE NO.2
162nd CCGP & 149th CCSQ
North Highlands ANG
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GEOLOGIC CROSS-SECTION A-A' AT IRP SITE NO.2

162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

FIGURE 5.10

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Table 5.9
Maximum Concentrations Detected in Soil Vapor Samples
Collected from IRP Site No. 2
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Analytical Parameter	Maximum Concentration Detected (ppmv)	Detection Limit (ppmv)
1,1 Dichloroethene	0.04	0.01
Methylene Chloride	ND	0.01
trans-1,2 Dichloroethene	ND	0.01
1,1 Dichloroethane	ND	0.01
Chloroform	0.39	0.01
1,1,1 Trichloroethane	ND	0.01
Carbon Tetrachloride	0.31	0.01
1,2 Dichloroethane	ND	0.01
Trichloroethene	ND	0.01
1,2 Dichloropropane	ND	0.01
Bromodichloromethane	0.13	0.01
cis-1,3 Dichloropropene	ND	0.01
trans-1,3 Dichloropropene	ND	0.01
1,1,2 Trichloroethane	ND	0.01
Tetrachloroethene	ND	0.01
Benzene	0.05	0.01
Toluene	0.30	0.01
Ethylbenzene	0.08	0.01
Total Xylenes	0.21	0.01
Total Petroleum Hydrocarbons	7.0	1.0

ppmv – parts per million by volume.

ND – Not Detected.

and from 0.07 to 0.21 ppmv, respectively, in two of the samples; and bromodichloromethane and ethylbenzene at 0.13 ppmv and 0.08 ppmv, respectively, in one of the samples analyzed.

Ethylbenzene and the highest concentrations of toluene and total xylenes were detected in the soil vapor sample collected from soil boring BH02-03 from a depth of 11.0 feet BLS, and the highest concentration of chloroform was detected in the sample collected from a depth of 41.0 feet BLS. The highest concentrations of carbon tetrachloride were detected in the soil vapor samples collected from borings BH02-02 and BH02-03 from a depth of 41.0 feet BLS. Benzene was detected at a concentration of 0.05 ppmv in the soil vapor samples collected from a depth of 11.0 feet BLS from borings BH02-01 and BH02-02. The highest concentration of 1,1-dichloroethene was detected in the sample collected from boring BH02-01 from a depth of 31.0 feet BLS. Bromodichloromethane was detected at a concentration of 0.13 ppmv in the soil vapor sample collected from boring BH02-04 from a depth of 51.0 feet BLS. The highest concentrations of TPH were detected in the soil vapor samples collected from borings BH02-02 and BH02-04 from depths of 61.0 feet BLS and 11.0 feet BLS, respectively.

5.4.2.2 Field GC Screening Results of Soil Samples

Fifty-three soil samples were field screened with a Photovac 10S55 Portable GC, calibrated to screen for BTEX. Table 5.10 summarizes the maximum concentrations detected in soil samples collected from IRP Site No. 2. Complete GC data is included in Appendix C.

Table 5.10
Maximum GC Concentrations Detected in Soil Samples
Collected from IRP Site No. 2
162nd CCGP and 149th CCSQ, North Highlands ANGS, Sacramento, California

Compound	Maximum Concentrations Detected in Soil Samples (ppb)
Benzene	ND
Toluene	40
Ethylbenzene	76
Xylenes	70

GC – Gas Chromatograph.
ppb – parts per billion.

Xylenes were detected at concentrations ranging from 7 to 70 ppb in two of the soil samples analyzed; and ethylbenzene and toluene at 76 ppb and 39 ppb, respectively, in one of the samples analyzed. Benzene was not detected in any of the samples analyzed.

All parameters, with the exception of xylenes, were detected only in soil sampled from boring BH02-01, located in the east portion of the site. Ethylbenzene and the highest concentration of xylenes were detected in the soil sample collected from immediately below the ground surface.

The highest concentration of toluene was detected in the sample collected from a depth of 36.0 feet BLS. Xylenes were also detected at a concentration of 7 ppb in the soil sample collected from boring BH02-04 from immediately below the ground surface.

5.4.3 Soil Investigation Findings

Soil samples collected from four soil borings were used to provide geologic information for describing the subsurface geology at IRP Site No. 2. Eleven investigative soil samples were submitted for laboratory analysis to provide an assessment of the presence and type of soil contamination present.

5.4.3.1 Soil Boring Locations

Four soil borings were installed at the site to obtain soil samples for laboratory analysis for defining any existing soil contamination, and to aid in defining the vertical and horizontal extent of contamination. Soil samples were also used for characterizing site geology and subsurface soil conditions. All soil borings, with the exception of BH-02-03, were drilled in the locations originally proposed in the Work Plan. The soil boring locations are indicated on Figure 5.11.

5.4.3.2 Nature and Extent of Soil Contamination

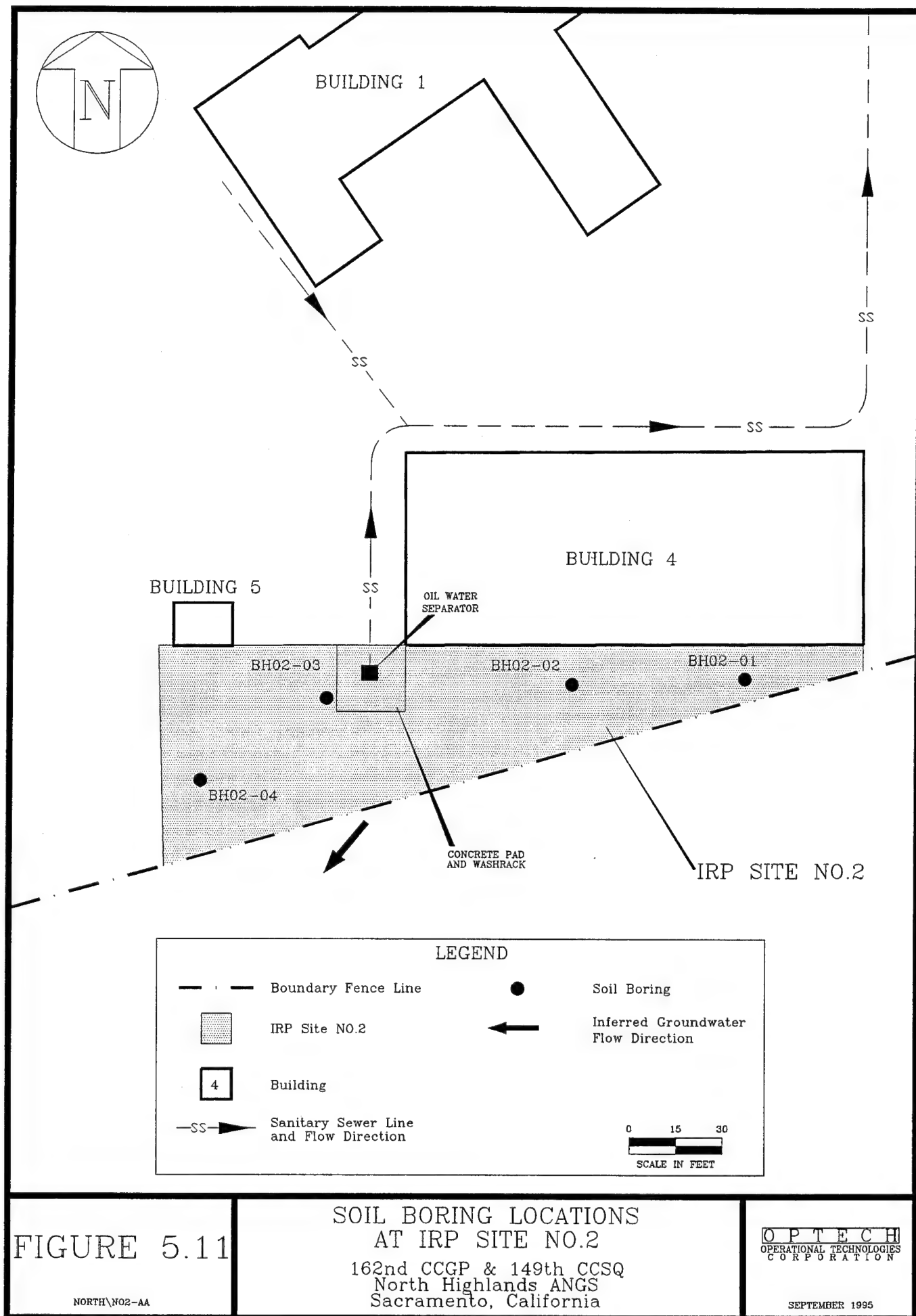
Four soil borings were installed at IRP Site No. 2 from which 11 investigative and two duplicate soil samples were collected for laboratory analysis. The borings were installed to a depth of 60.0 feet BLS, with the exceptions of boring BH02-01 which was drilled to a depth of 63.5 feet BLS and boring BH02-04 which was drilled to a depth of 110.5 feet BLS. Soil samples were collected on 21, 22, and 23 June 1994.

VOC and SVOC surrogate recoveries ranged from 86 to 115 percent and 45 to 94 percent, respectively, which are within acceptable limits. VOC and SVOC matrix spike recoveries ranged from 76 to 112 percent and 36 to 100 percent, respectively, which are within acceptable ranges. Quality assurance/quality control sample analytical results are reported in Appendix D. A complete listing of the results for all analytical parameters for each sample is given in Appendix E.

No VOCs, SVOCs, TPH, or oil and grease were detected in soil samples collected from IRP Site No. 2.

5.4.3.2.1 Metals Contamination

Soil samples were analyzed for priority pollutant metals using method SW6020, with the exception of samples collected from borings BH02-03 from a depth of 42.0 feet BLS and BH02-04 from depths of 105.0 feet BLS and 110.0 feet BLS, which were analyzed using method SW6010. Samples were analyzed by method SW6010 when laboratory equipment used for method SW6020 malfunctioned and repairs could not be made in a timely fashion. Consequently, soil samples analyzed by method SW6010 reflect higher reporting limits due to limitations of that method.



Metals detected in soil samples collected from IRP Site No. 2 are shown in Table 5.11. Arsenic was detected at concentrations ranging from 0.52 to 1.8 mg/kg in six of the 13 samples analyzed, with the highest concentration detected in the soil sample collected from boring BH02-02 from a depth of 42.0 feet BLS. Selenium was detected in one of the 13 samples analyzed at a concentration of 0.23 mg/kg in the soil sample collected from boring BH02-03 from a depth of 42.0 feet BLS. Arsenic and selenium were not detected in the background soil samples. Chromium was detected at concentrations ranging from 4.7 to 28.0 mg/kg with concentrations exceeding background in five of the 13 samples analyzed. Chromium was detected at concentrations exceeding background in soil sampled from borings BH02-01 from a depth of 32.0 feet BLS and BH02-04 from depths of 52.0 feet BLS, 105.0 feet BLS, and 110.0 feet BLS.

Copper was detected at concentrations ranging from 9.4 to 85.0 mg/kg, with concentrations exceeding background in 12 of the 13 soil samples analyzed, with the exception being the sample collected from boring BH02-02 from a depth of 42.0 feet BLS. The highest concentration was detected in the soil sample collected from boring BH02-01 from a depth of 62.0 feet BLS. Lead was detected at concentrations ranging from 1.7 to 6.5 mg/kg, with concentrations exceeding background in soil samples collected from borings BH02-01 from depths of 32.0 feet BLS and 62.0 feet BLS and BH02-03 from a depth of 42.0 feet BLS. Mercury was detected at a concentration exceeding background in one of the 13 samples analyzed at a concentration of 0.080 mg/kg in the sample collected from boring BH02-04 from a depth of 12.0 feet BLS. Nickel was detected at concentrations ranging from 8.9 to 56.0 mg/kg, with concentrations exceeding background in soil samples collected from boring BH02-04 from depths of 105.0 feet BLS and 110.0 feet BLS. Zinc was detected at concentrations ranging from 27.0 to 67.0 mg/kg, with concentrations exceeding background in the soil sample collected from boring BH02-04 from a depth of 110.0 feet BLS and in all soil samples collected from borings BH02-01 and BH02-02.

A TDL was calculated for each metal using the Designated Level Methodology. TDLs for soil samples collected from depths shallower than 62.0 feet BLS were calculated by multiplying water quality goals (expressed in mg/L) by a generic environmental attenuation factor (100) and the generic leachability factor for inorganics (100). An attenuation factor of 100 was applied because 45.0 feet of fine silts lie between that depth and groundwater. For soil samples collected from depths ranging from 92.0 to 110.0 feet BLS, an attenuation factor was not used in the calculation because of the proximity to groundwater. The most limiting available and applicable water quality goal for each metal was utilized. The TDLs are indicated in Table 5.11 and were derived for use as cleanup levels for metals. All of the above metals were detected

Table 5.11
Metals Detected in Soil Samples
Collected from IRP Site No. 2
162nd CCGP and 149th CCSQ, North Highlands ANG, Sacramento, California

Sample ID Number	Arsenic mg/kg	Chromium mg/kg	Copper mg/kg	Lead mg/kg	Nickel mg/kg	Mercury mg/kg	Zinc mg/kg	Selenium mg/kg
BH02-01-32'	0.76	11.0	21.0	5.8	14.0	0.20U	67.0	0.040U
BH02-01-62'	0.500U	9.5	85.0	4.3	15.0	0.20U	66.0	0.039U
BH02-01-62'-Dup	0.52	6.5	15.0	2.5	8.9	0.046	39.0	0.040U
BH02-02-42'	1.8	4.7	9.4	2.4	9.6	0.20U	38.0	0.040U
BH02-02-59'	0.500U	8.3	24.0	3.3	15.0	0.20U	51.0	0.040U
BH02-03-42'	30.0U	8.4	13.0	6.5	50.0U	0.010U	29.0	0.23
BH02-03-59'	0.67	10.0	16.0	4.0	13.0	0.010U	33.0	0.15U
BH02-04-12'	0.99	8.6	22.0	4.0	9.1	0.080	30.0	0.040U
BH02-04-52'	1.0	11.0	21.0	3.7	15.0	0.010U	28.0	0.039U
BH02-04-92'	0.500U	10.0	16.0	2.6	12.0	0.010U	29.0	0.039U
BH02-04-GW-105'*	1.0U	23.0	16.0	1.5U	41.0	0.016	27.0	1.0U
BH02-04-GW-105'-Dup*	1.0U	26.0	17.0	1.7	42.0	0.014	30.0	1.0U
BH02-04-110'	1.0U	28.0	34.0	3.0	56.0	0.017	45.0	1.00U
Maximum Background Concentrations	0.500U	10.0	11.0	4.0	19.0	0.050	34.0	0.040U
Range of Naturally-Occurring Regional Concentrations ^d	6.5 - 16	50 - 100	30 - 700	10 - 20	20 - 700	.051 - .02	45 - 120	0.2 - 0.5
Total Designated Levels above 62.0 feet BLS	500.0 ^b	500.0 ^b	10,000.0 ^c	500.0 ^b	1,000.0 ^a	20.0 ^b	50,000.0 ^c	100.0 ^b
Total Designated Levels below 62.0 feet BLS	5.0 ^b	5.0 ^b	100.0 ^c	5.0 ^b	10.0 ^a	0.2 ^b	500.0 ^c	1.0 ^b

mg/kg - milligrams per kilogram.

BH - Borehole.

U - Compound was analyzed for but not detected. Number preceding "U" indicates the detection limit.

*Samples were collected as groundwater samples. However, the high silt content of the samples precluded them from being analyzed as water samples. Filtering was not considered a feasible option and the samples were analyzed as solids.

^aUSEPA Primary Maximum Contaminant Level (MCL) used as the water quality goal.

^bCalifornia Dept. of Health Services Primary MCL used as the water quality goal.

^cCalifornia Dept. of Health Services Secondary MCL used as the water quality goal.

^dShacklette and Boerngen, 1984.

at concentrations well below their respective TDL, with the exception of chromium and nickel at depths below 92.0 feet BLS (see Table 5.11).

5.4.4 Conclusions

Soil vapor samples and soil samples were collected from IRP Site No. 2 and submitted for laboratory analysis to confirm the presence or absence of contamination and to provide data needed to reach a decision point for the site. Past activities at the site indicated that suspected contamination consists primarily of waste solvents, paints, and thinners. Therefore, soil vapor samples were submitted for analysis of halogenated volatile hydrocarbons, BTEX, and TPH. Soil samples were submitted for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease.

Soil vapor samples were collected during the drilling of soil borings. Ethylbenzene, toluene, total xylenes, and chloroform were detected at maximum concentrations of 0.08 ppmv, 0.30 ppmv, 0.21 ppmv, and 0.39 ppmv, respectively, in soil vapor samples collected from BH02-03. Benzene was detected at a concentration of 0.05 ppmv in the soil vapor samples collected from borings BH02-01 and BH02-02 from a depth of 11.0 feet BLS. Carbon tetrachloride was detected at a maximum concentration of 0.31 ppmv in the soil vapor samples collected from borings BH02-02 and BH02-03 from a depth of 41.0 feet BLS. 1,1-Dichloroethene was detected at a maximum concentration of 0.04 ppmv in the soil vapor sample collected from boring BH02-01 from a depth of 31.0 feet BLS. Bromodichloromethane was detected at a maximum concentration of 0.13 ppmv in the soil vapor sample collected from boring BH02-04 from a depth of 51.0 feet BLS. TPH was detected at a maximum concentration of 7.0 ppmv in soil vapor samples collected from IRP Site No. 2. Parameters detected in the soil vapor sampling were not confirmed in the soil samples collected and submitted for laboratory analysis from IRP Site No. 2.

Only those parameters detected in soil samples, reported at greater than the method reporting limit, exceeding TDLs, derived for use as cleanup levels, are addressed in this section.

Chromium and nickel were detected at concentrations exceeding TDLs in soil samples collected from boring BH02-04 from depths of 92.0 feet BLS, 105.0 feet BLS, and 110.0 feet BLS. Chromium was detected at concentrations of 10.0 mg/kg, 23.0 mg/kg, 26.0 mg/kg, and 28.0 mg/kg in samples collected from depths of 92.0 feet BLS, 105.0 feet BLS, 105.0 feet BLS (duplicate), and 110.0 feet BLS, respectively. Nickel was detected at concentrations of 12.0 mg/kg, 41.0 mg/kg, 42.0 mg/kg, and 56.0 mg/kg in samples collected from depths of 92.0 feet

BLS, 105.0 feet BLS, 105.0 feet BLS (duplicate), and 110.0 feet BLS, respectively. As shown in Table 5.11, these concentrations of chromium and nickel are below the respective ranges of naturally-occurring concentrations of each of these metals for the Sacramento area.

SECTION 6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY

An SI was conducted at IRP Site No. 1 (Old AGE Area) and IRP Site No. 2 (Area Behind Vehicle Maintenance), located at the 162nd CCGP and the 149th CCSQ, North Highlands ANG, Sacramento, California. IRP Sites No. 1 and No. 2 were identified during the PA, conducted by Science and Technology, INC., in 1990, and recommended for further investigation under the IRP.

The HQ ANG/CEVR authorized OpTech to prepare an SI Work Plan and conduct the SI at IRP Sites No. 1 and No. 2. This investigation was conducted as outlined in the SI Work Plan submitted to and approved by HQ ANG/CEVR in March 1994. The field investigation at North Highlands ANG commenced on 20 June 1994 and was completed on 29 June 1994.

The field investigation at North Highlands ANG was accomplished by completing the following tasks:

- Drill one background soil boring from which six soil vapor samples were collected and analyzed for halogenated volatile hydrocarbons, BTEX, and TPH, and two soil samples were collected for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease to determine background levels;
- Drill 5 soil borings at IRP Site No. 1 to determine whether contamination exists at the site;
- Collect 28 soil vapor samples for analysis of halogenated volatile hydrocarbons, BTEX, and TPH, and 11 soil samples for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease from IRP Site No. 1;
- Drill 4 soil borings at IRP Site No. 2 to determine whether contamination exists at the site;
- Collect 28 soil vapor samples for analysis of halogenated volatile hydrocarbons, BTEX, and TPH, and 11 soil samples for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease from IRP Site No. 2; and
- Survey the location and elevation of all soil borings.

6.2 CONCLUSIONS

6.2.1 IRP Site No. 1 (Old AGE Area)

IRP Site No. 1 is located on the southwest side of North Highlands ANG. This area was used for the maintenance of grounds equipment from the early 1960s until 1980. Those maintenance operations resulted in frequent releases of small amounts of waste oils, solvents, fuels, paint, and thinners.

Soil vapor samples were collected during the drilling of soil borings. The highest concentrations of detected parameters were in soil vapor samples collected from soil boring BH01-03, located in the center of the site. Benzene and toluene were detected at maximum concentrations of 0.19 ppmv and 0.13 ppmv, respectively, in the soil vapor sample collected from a depth of 11.0 feet BLS. Methylene chloride, ethylbenzene and total xylenes were detected at maximum concentrations of 0.11 ppmv, 0.16 ppmv, and 0.15 ppmv, respectively, in the soil vapor sample collected from a depth of 21.0 feet BLS. TPH was detected at a maximum concentration of 3.0 ppmv in soil vapor samples collected from IRP Site No. 1.

Soil samples were collected from IRP Site No. 1 and submitted for laboratory analysis to confirm the presence or absence of contamination and to provide data needed to reach a decision point for the site. Past activities at the site indicated that suspected contamination consists primarily of waste oils, solvents, paint, and thinners. Therefore, samples were submitted for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease. Data validation did not uncover any problems which would affect the investigation.

6.2.1.1 Soil Contamination

Parameters detected in the soil vapor sampling were not confirmed in the soil samples collected and submitted for laboratory analysis. Thallium was the only contaminant detected in soil samples collected during the SI at concentrations exceeding TDLs, derived for use as cleanup levels.

Thallium was detected at a concentration of 34.0 mg/kg in the soil sample collected from boring BH01-03 from a depth of 58.0 feet BLS and a concentration of 36.0 mg/kg in samples collected from borings BH01-02 and BH01-05 from a depth of 59.0 feet BLS.

6.2.2 IRP Site No. 2 (Area Behind Vehicle Maintenance)

IRP Site No. 2 is located on the east side of North Highlands ANG. Small amounts of waste solvents, paints, and thinners were periodically poured along the boundary fence from the late 1950s through the mid-1960s.

Soil vapor samples were collected during the drilling of soil borings. Ethylbenzene, toluene, total xylenes, and chloroform were detected at maximum concentrations of 0.08, 0.30 ppmv, 0.21 ppmv, and 0.39 ppmv, respectively, in soil vapor samples collected from BH02-03. Benzene was detected at a concentration of 0.05 ppmv in the soil vapor samples collected from borings BH02-01 and BH02-02 from a depth of 11.0 feet BLS. Carbon tetrachloride was detected at a maximum concentration of 0.31 ppmv in the soil vapor samples collected from borings BH02-02 and BH02-03 from a depth of 41.0 feet BLS. 1,1-Dichloroethene was detected at a maximum concentration of 0.04 ppmv in the soil vapor sample collected from boring BH02-01 from a depth of 31.0 feet BLS. Bromodichloromethane was detected at a maximum concentration of 0.13 ppmv in the soil vapor sample collected from boring BH02-04 from a depth of 51.0 feet BLS. TPH was detected at a maximum concentration of 7.0 ppmv in soil vapor samples collected from IRP Site No. 2.

Soil samples were collected from IRP Site No. 2 and submitted for laboratory analysis to confirm the presence or absence of contamination and to provide data needed to reach a decision point for the site. Past activities at the site indicated that suspected contamination consists primarily of waste solvents, paints, and thinners. Therefore, samples were submitted for analysis of VOCs, SVOCs, priority pollutant metals, TPH, and oil and grease. Data validation did not uncover any problems which would affect the investigation.

6.2.2.1 Soil Contamination

Parameters detected in the soil vapor sampling were not confirmed in the soil samples collected and submitted for laboratory analysis. Chromium and nickel were the only contaminants detected in soil samples collected during the SI at concentrations exceeding TDLs, derived for use as cleanup levels.

Chromium and nickel were detected at concentrations exceeding TDLs in soil samples collected from boring BH02-04 from depths of 92.0 feet BLS, 105.0 feet BLS, and 110.0 feet BLS. Chromium was detected at concentrations of 10.0 mg/kg, 23.0 mg/kg, 26.0 mg/kg, and 28.0 mg/kg in samples collected from depths of 92.0 feet BLS, 105.0 feet BLS, 105.0 feet BLS

(duplicate), and 110.0 feet BLS, respectively. Nickel was detected at concentrations of 12.0 mg/kg, 41.0 mg/kg, 42.0 mg/kg, and 56.0 mg/kg in samples collected from depths of 92.0 feet BLS, 105.0 feet BLS, 105.0 feet BLS (duplicate), and 110.0 feet BLS, respectively. These concentrations of chromium and nickel do not exceed the respective ranges of naturally-occurring concentrations of each of these metals for the Sacramento area.

6.3 RECOMMENDATIONS

Based on the results of the SI conducted, the following recommendations are presented:

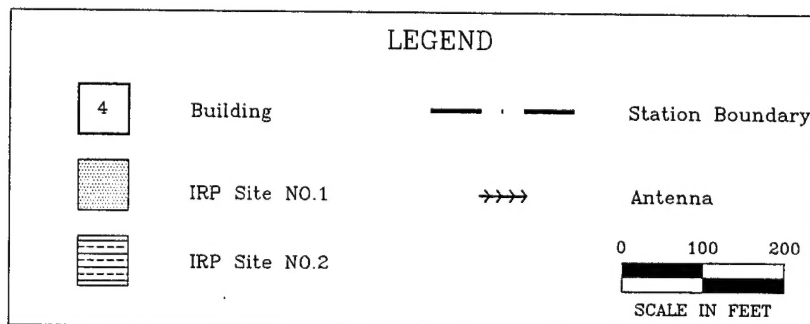
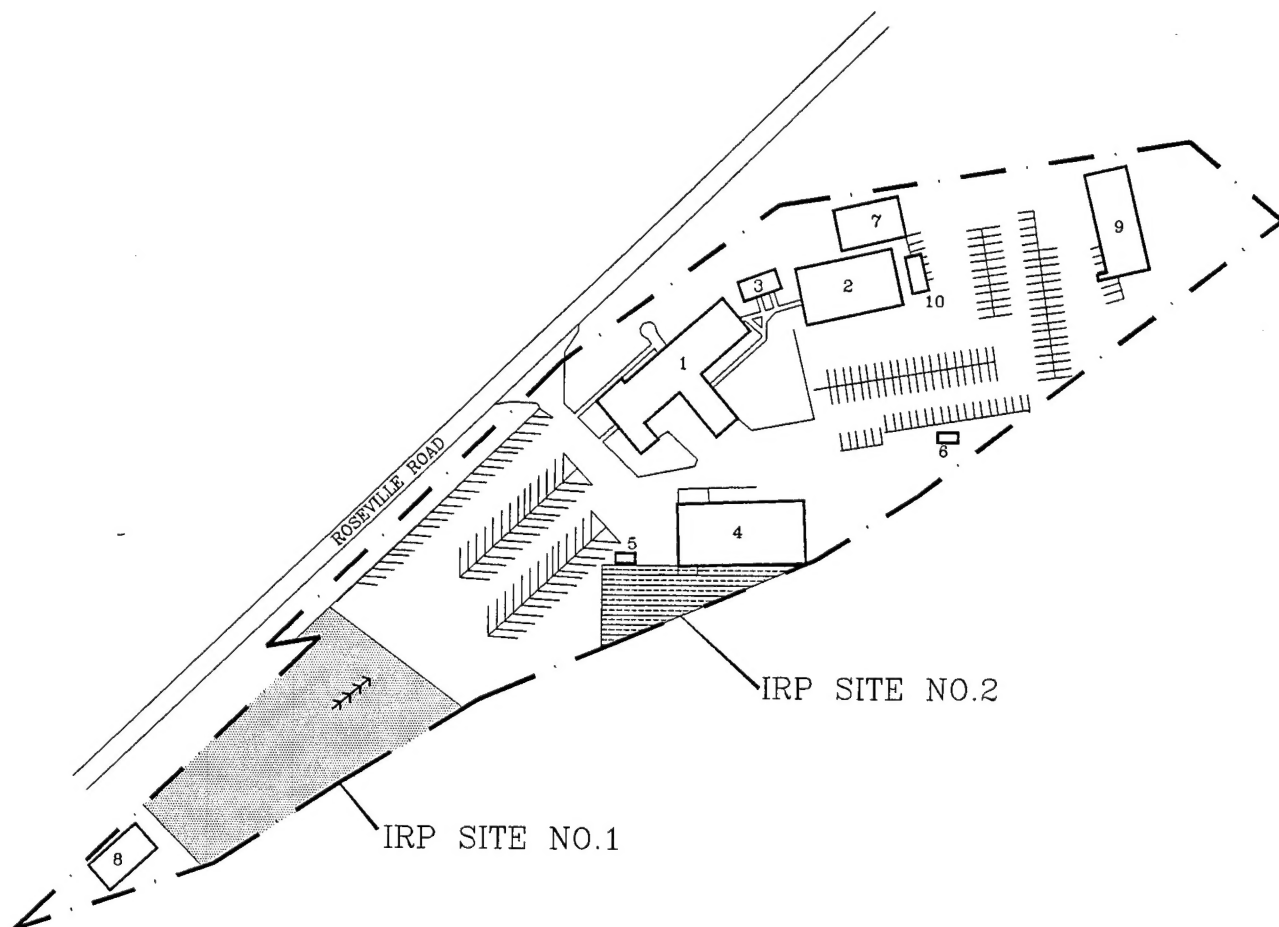
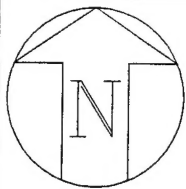
- The results of the SI indicate no further IRP work is required at IRP Site No. 1. A Decision Document recommending No Further Action (NFA) should be prepared.
- The results of the SI indicate no further IRP work is required at IRP Site No. 2. A Decision Document recommending No Further Action (NFA) should be prepared.

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INSIDE
BACK
COVER
NORTH\NHGH4-2L

LOCATION OF IRP SITES
NO.1 AND NO.2
162nd CCGP & 149th CCSQ
North Highlands ANG
Sacramento, California

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SEPTEMBER 1995